

DIABETIC KIDNEY DISEASE THE EXTRARENAL STORY....



ESSAM NOUR ELDIN MD

ASU

Complications of Type 2 Diabetes

Microvascular Complications

Diabetic Retinopathy

Leading cause of blindness in working-age adults



Diabetic Nephropathy

Leading cause of end-stage renal disease



Diabetic Neuropathy

Leading cause of nontraumatic lower extremity amputations



Macrovascular Complications

Stroke

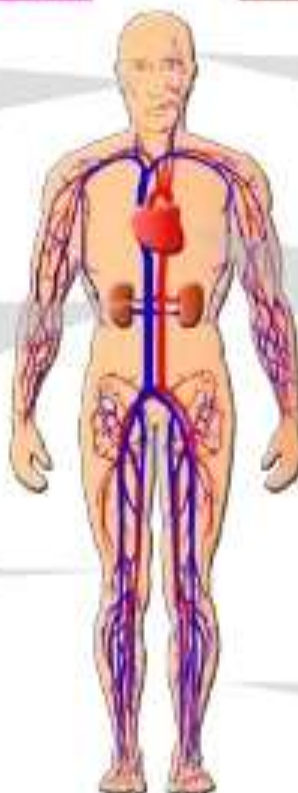
2- to 4-fold increase in cardiovascular mortality and stroke



Heart Disease



Peripheral Vascular Disease



Major **COMPLICATIONS** from diabetes



Wounds in foot
that won't
heal, leading to
AMPUTATION

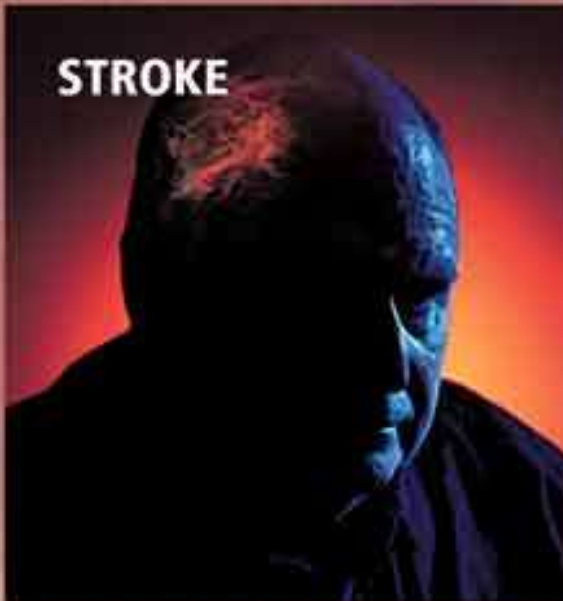


**HEART
DISEASE**



Damaged
blood vessels
in retina
which
can cause
BLINDNESS

STROKE



KIDNEY FAILURE

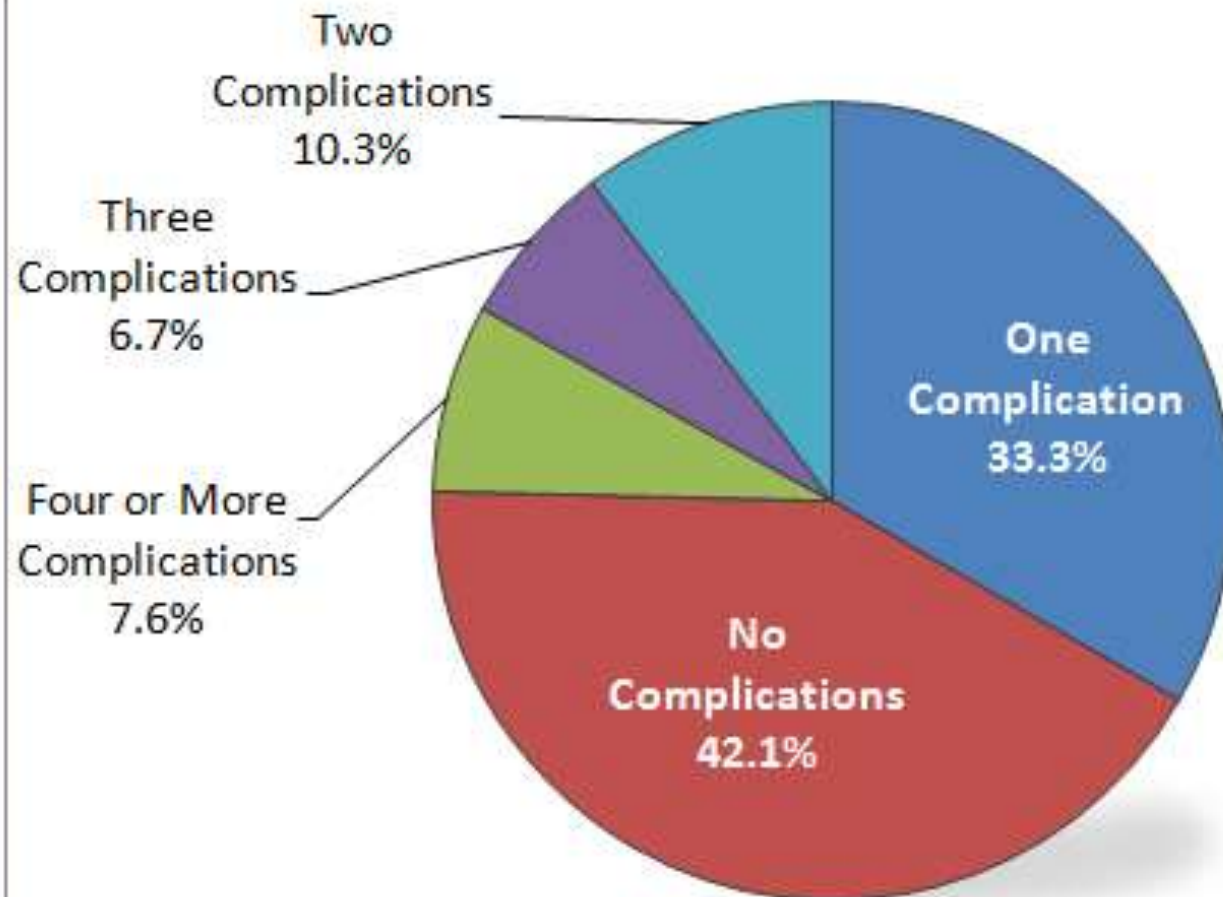


AFFLICTIONS OF DIABETES

- Life expectancy is shortened by 5 to 10 years or more
- It contributes to 160,000 deaths each year
- Two to twelve times the risk for heart disease
- Two to four times the risk of stroke
- Number one cause of blindness in adults with 12,000 to 24,000 new cases annually
- A factor in half of all foot and leg amputations
- Over 60,000 amputations yearly in diabetics
- In any given year, over 50,000 diabetics are either on dialysis, or have had a kidney transplant (due to diabetic nephropathy)
- Cause of peripheral neuropathy
- Increased risk of breast and uterine cancers



Figure 2. Prevalence of Diabetes-related Complications Among People With Diabetes, 1999-2004^[8]

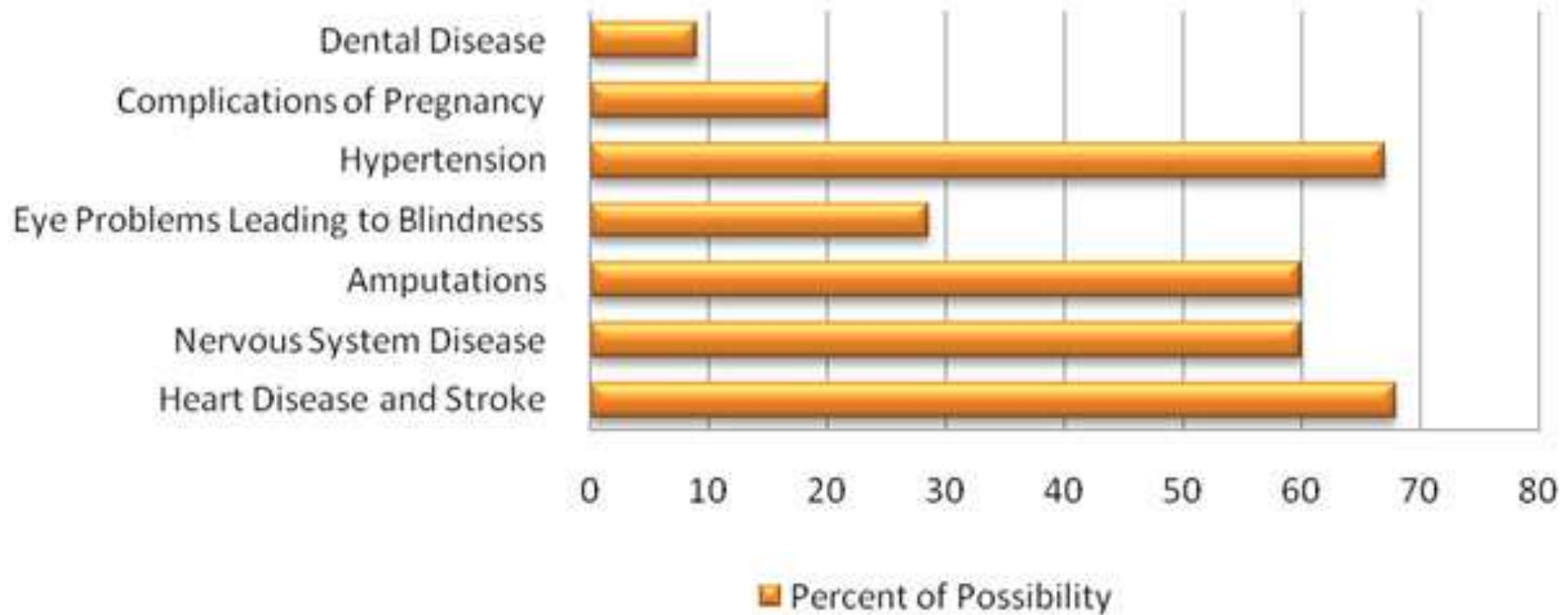


Data extrapolated from the National Health and Nutrition Examination Survey (NHANES) 1999-2004,

1 out of 3 people (33.3%) has 1 complication, 1 out of 10 (10.3%) has 2 complications, 1 out of 15 (6.7%) has 3 complications, and 1 out of 13 (7.6%) has 4 or more complications



Leading Complications of Diabetes

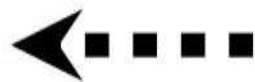


Diabetes epidemic is an epidemic of diabetic complications

2025 = 380 million

70%

Eye disease



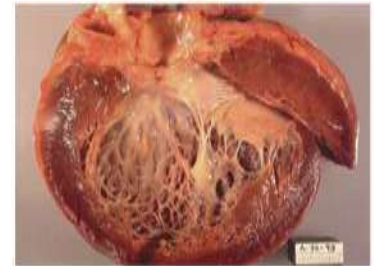
DIABETES



Heart

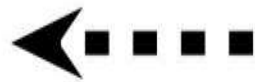
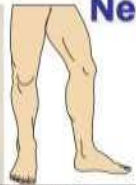


70%



40%

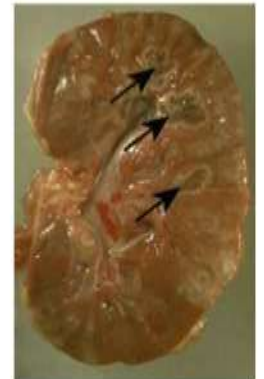
Nerves



Kidney



30%



270 million develop complications

Table 5: Common associated problems in type 2 diabetic patients with diabetic nephropathy

Microvascular complications

- Retinopathy (non-proliferative, proliferative)
- Polyneuropathy including autonomic polyneuropathy
- Cystopathy (detrusor paresis)
- Gastroparesis
- Neuropathic ulcer (diabetic foot)
- Impotence

Macrovascular complications (Atherosclerosis)

- Coronary heart diseases
- Cerebrovascular disease
- Peripheral vascular diseases
- Ischemic nephropathy (renal artery stenosis and cholesterol microembolism)

Others

- Hypertensive/non-hypertensive cardiomyopathy



DKD WITH ESRD CO-MORBIDITIES

CO-MORBIDITY	% in TYPE-1 D.M.	% in TYPE-2 D.M.
RETINOPATHY	92	75
NEUROPATHY	83	82
HEART DISEASE	67	75
VASCULAR DISEASE	29	21

DIABETIC NEPHROPATHY WITH ESRD CO-MORBIDITIES

1/2 of all patients have significant **C.A.D.**

1/3 of all patients have bilateral **BLINDNESS**

1/4 of all patients have **LIMB AMPUTATIONS**

10% of all patients have **C.V.STROKE.**

Diabetic complications which persist and/or progress during ESRD

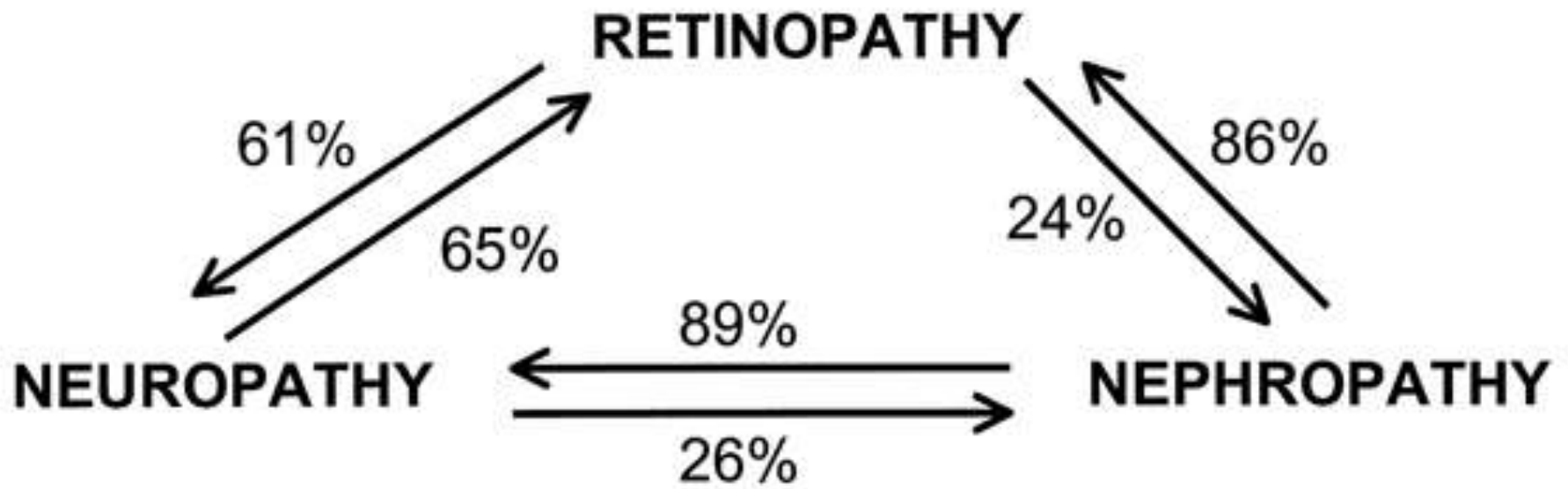
- 1. Retinopathy, glaucoma, cataracts.**
- 2. Coronary artery disease; Cardiomyopathy.**
- 3. Cerebrovascular disease.**
- 4. Peripheral vascular disease: limb amputation.**
- 5. Motor neuropathy; Sensory neuropathy**
- 6. Autonomic dysfunction: diarrhea, erectile dysfunction, hypotension.**
- 7. Myopathy.**
- 8. Depression.**



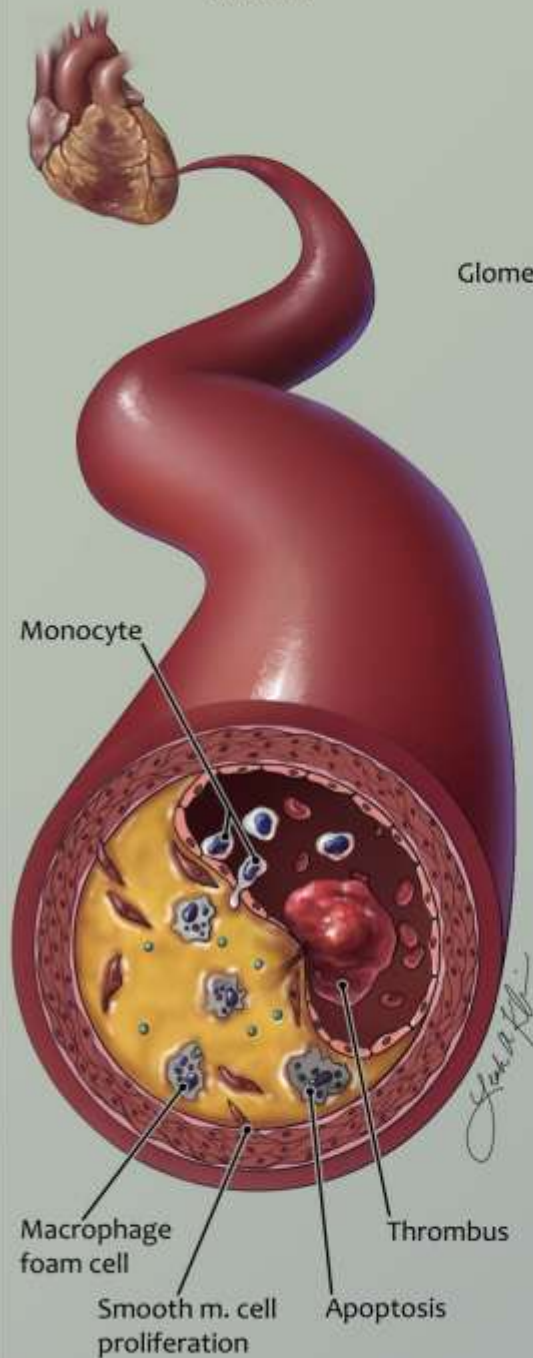


The mortality in DM patients under RRT can be twice that of non-DM ESRD patients over a 10-year period.

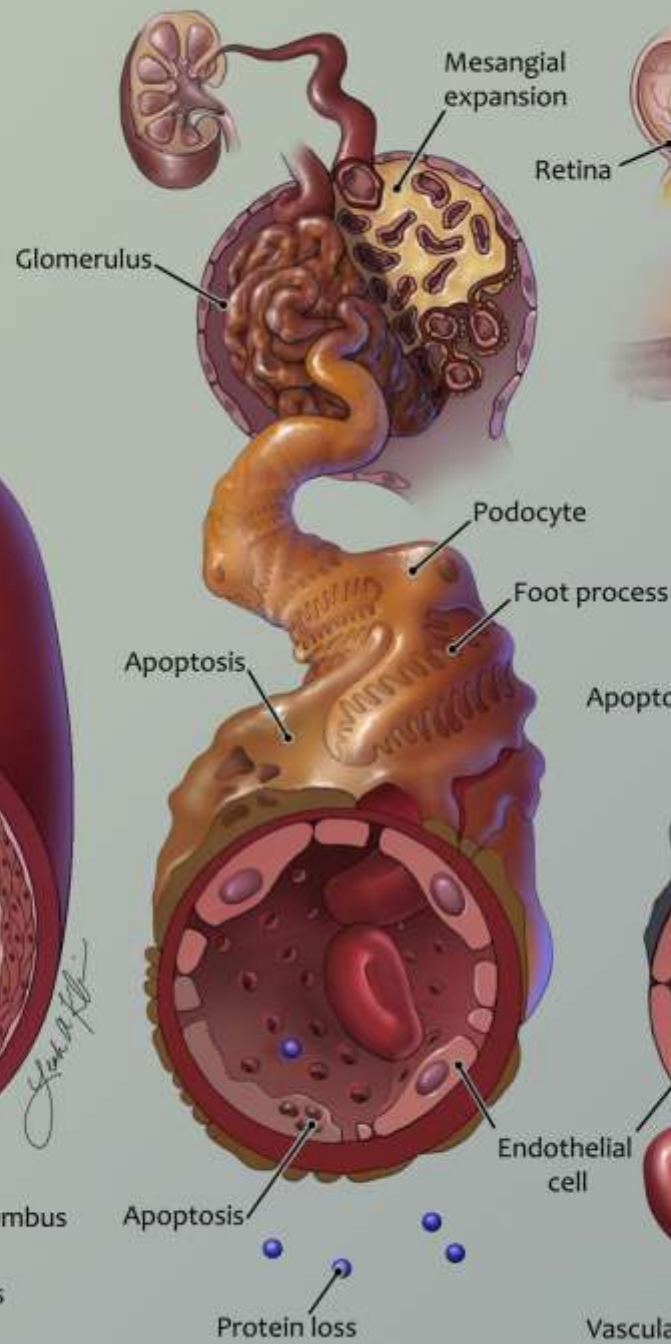
Van Dijk PC et al.: Renal replacement therapy for diabetic endstage renal disease: data from 10 registries in Europe (1991-2000).
Kidney Int. 2005; 67(4):1489-99.



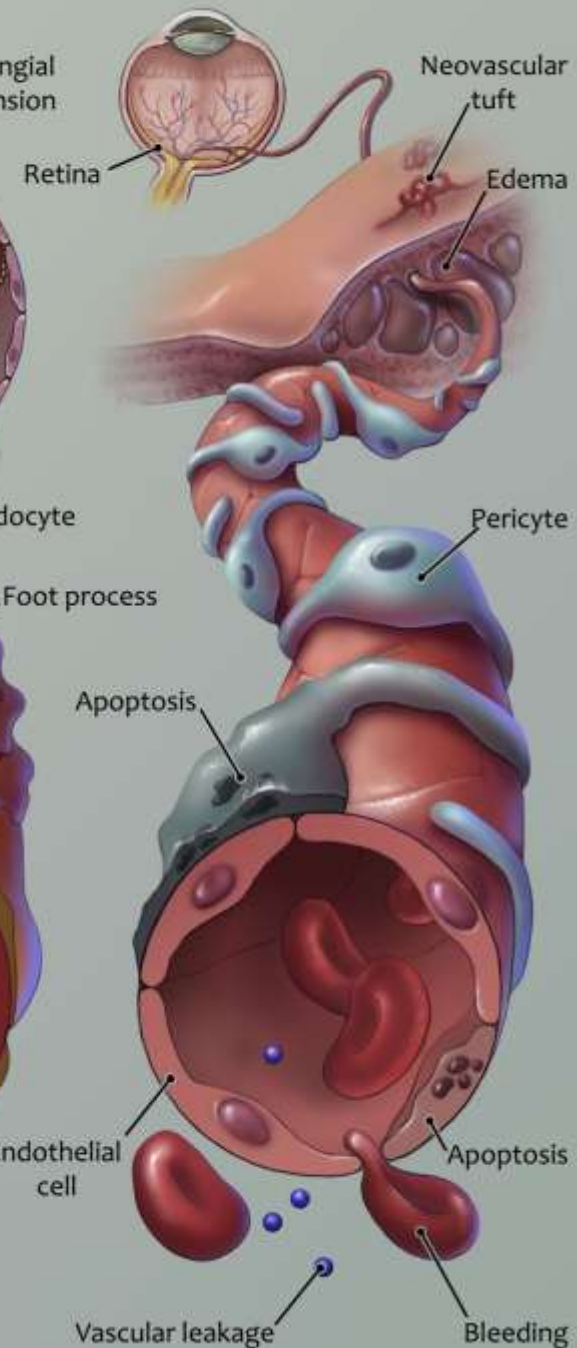
ARTERY



GLOMERULAR CAPILLARY

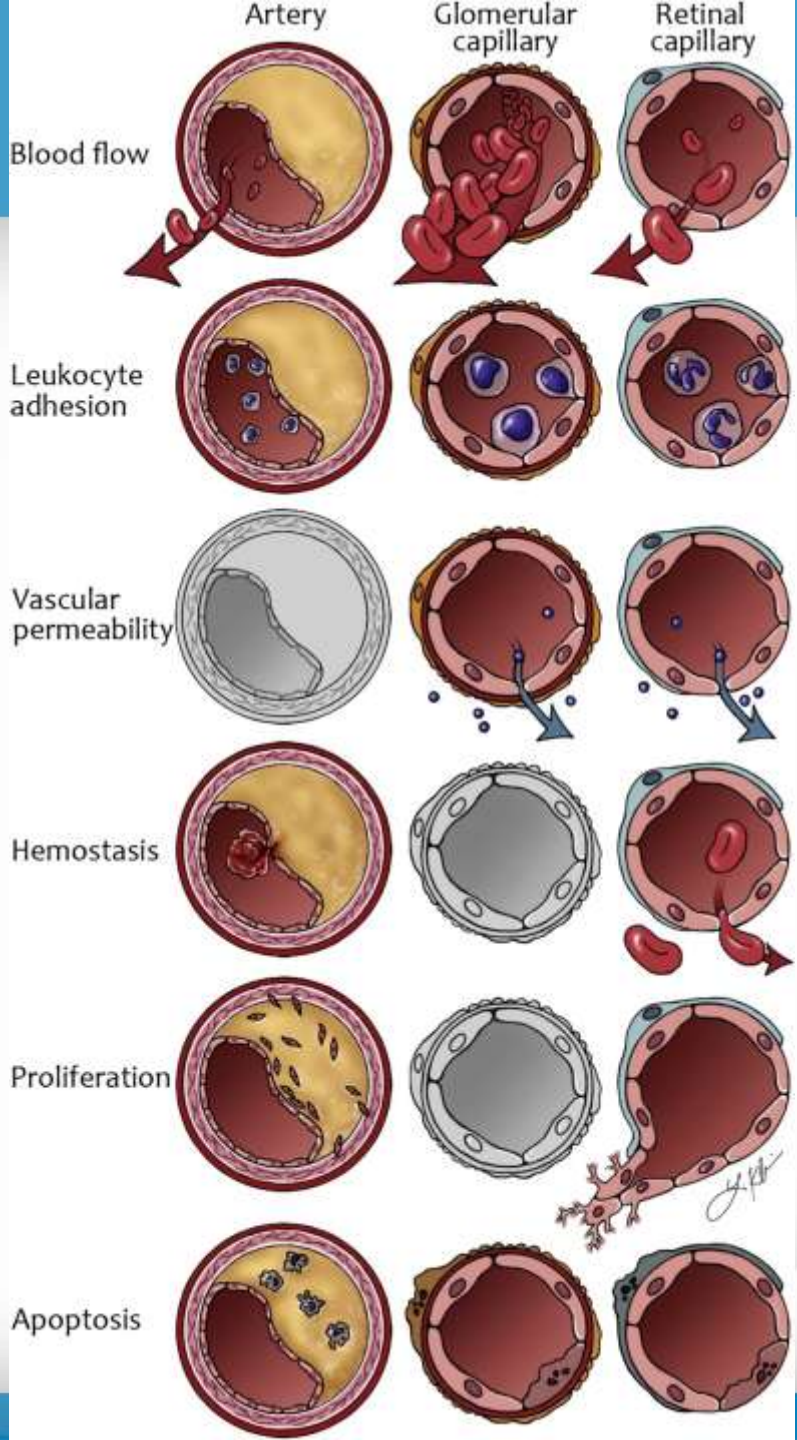


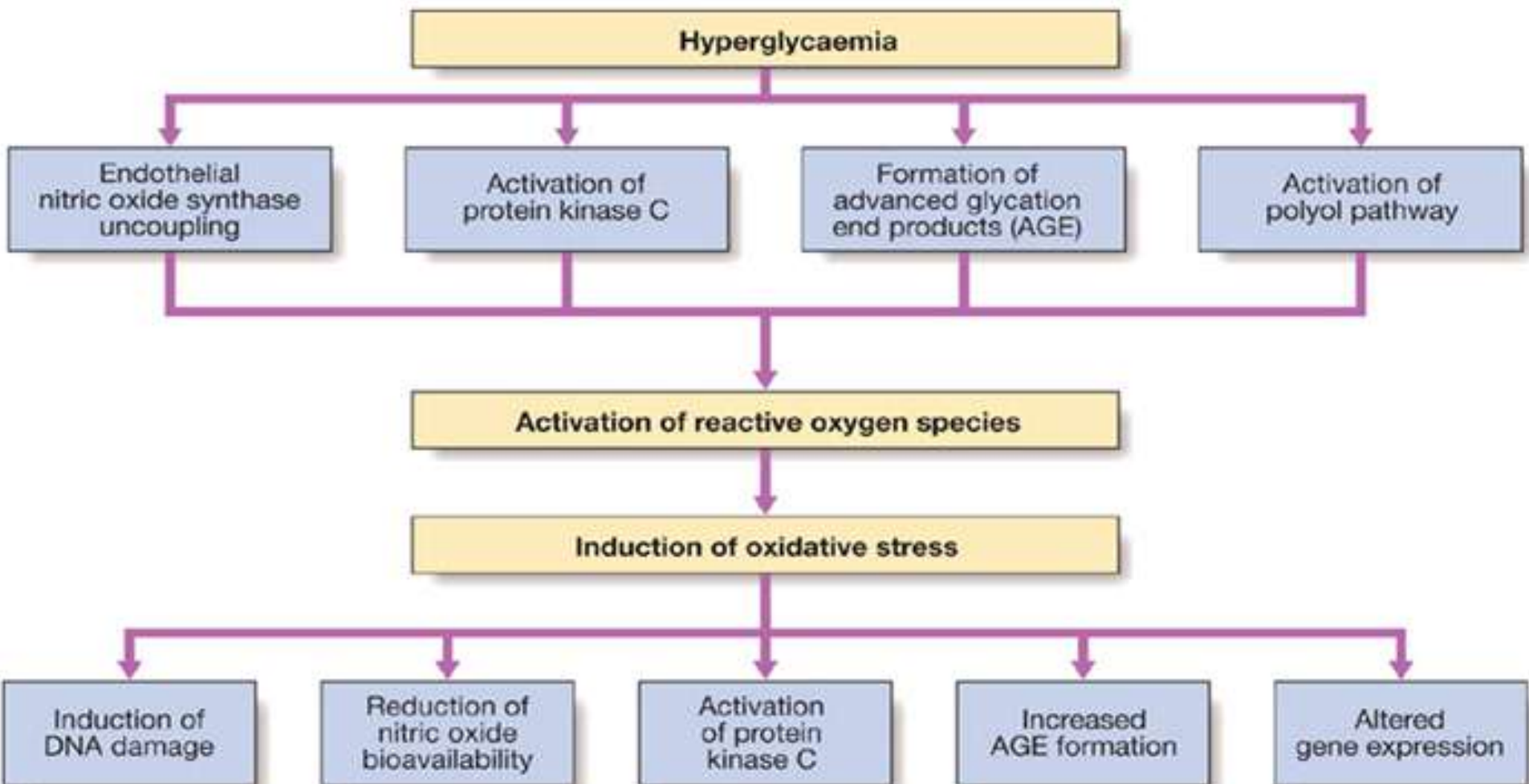
RETINAL CAPILLARY



Cell Metabolism 2013
17, 20-33DOI:
(10.1016/j.cmet.2012.
11.012)

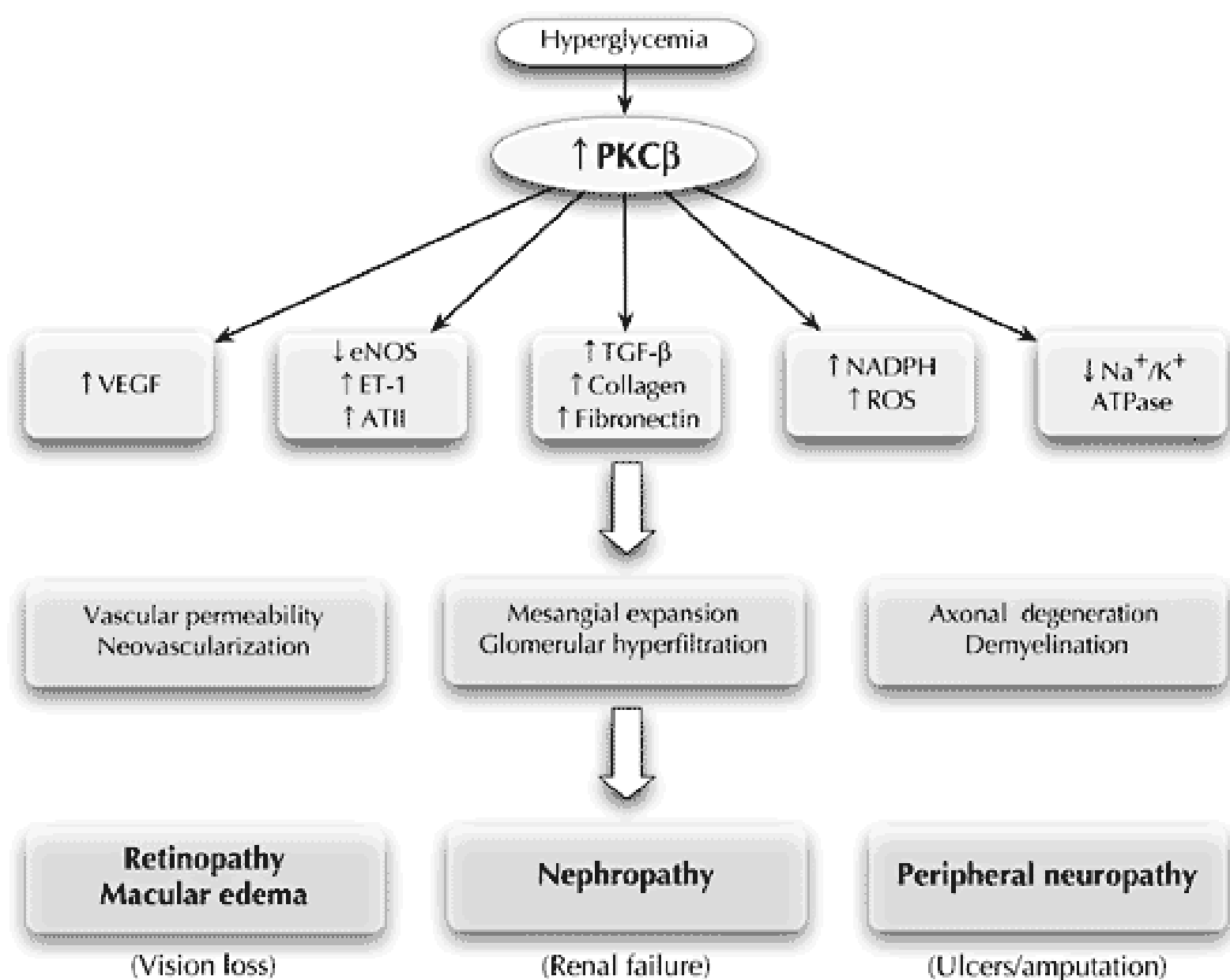
Cell Metabolism 2013 17, 20-33
DOI:(10.1016/j.cmet.2012.11.012)

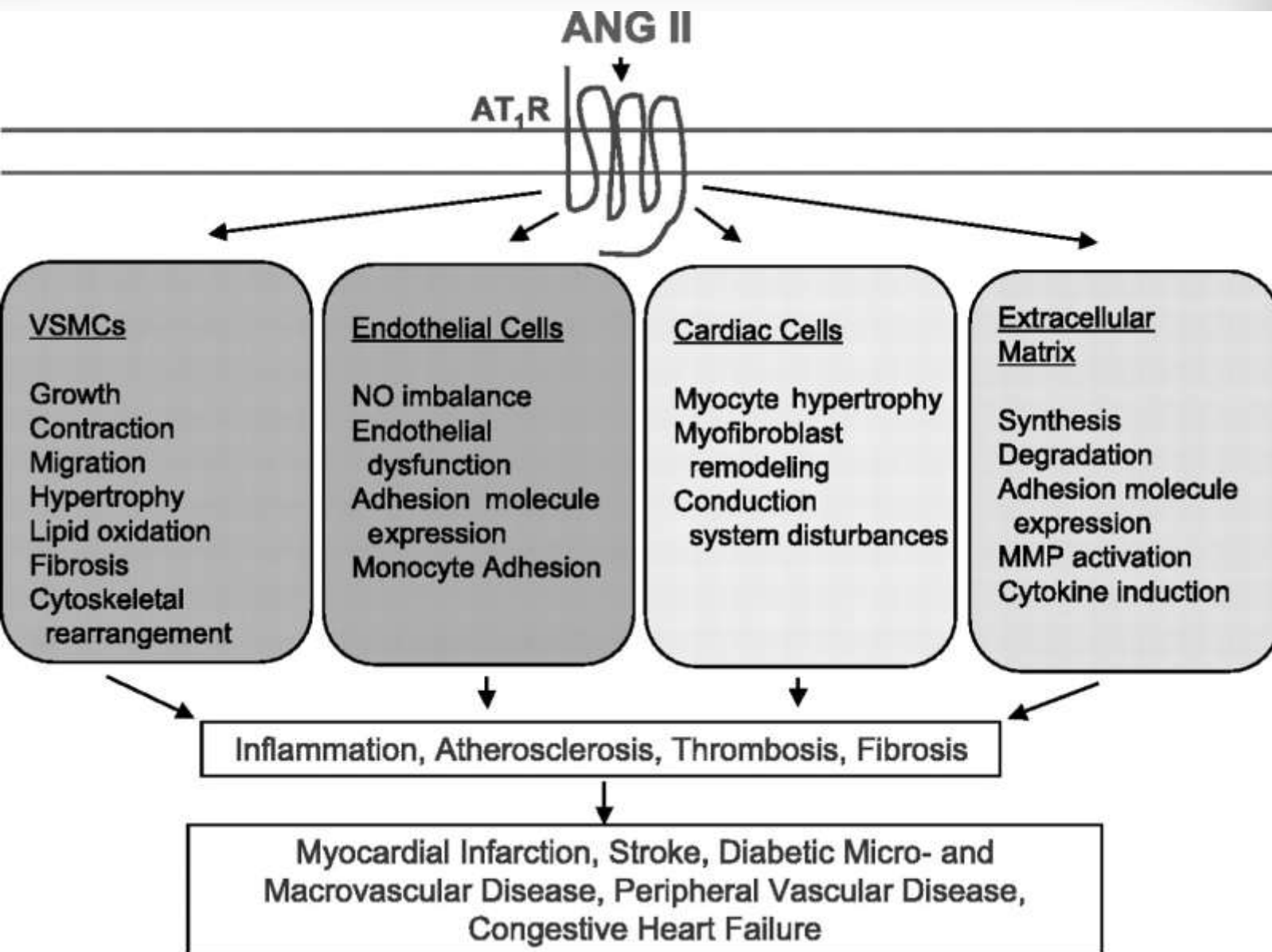




Colledge et al: Davidson's Principles and Practice of Medicine, 21st Edition
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Diabetes Complications



Blindness due to severe proliferative retinopathy or maculopathy is approximately **five times more frequent** in type 1 and type 2 diabetic patients with nephropathy than in normoalbuminuric patients.

Gall M-A, Rossing P, Skøtt P, et al. Prevalence of micro- and macroalbuminuria, arterial hypertension, retinopathy and large vessel disease in European type 2 (non-insulin-dependent) diabetic patients. *Diabetologia*. 1991;34:655-661.



Diabetic Retinopathy

Newly Formed
Blood Vessels

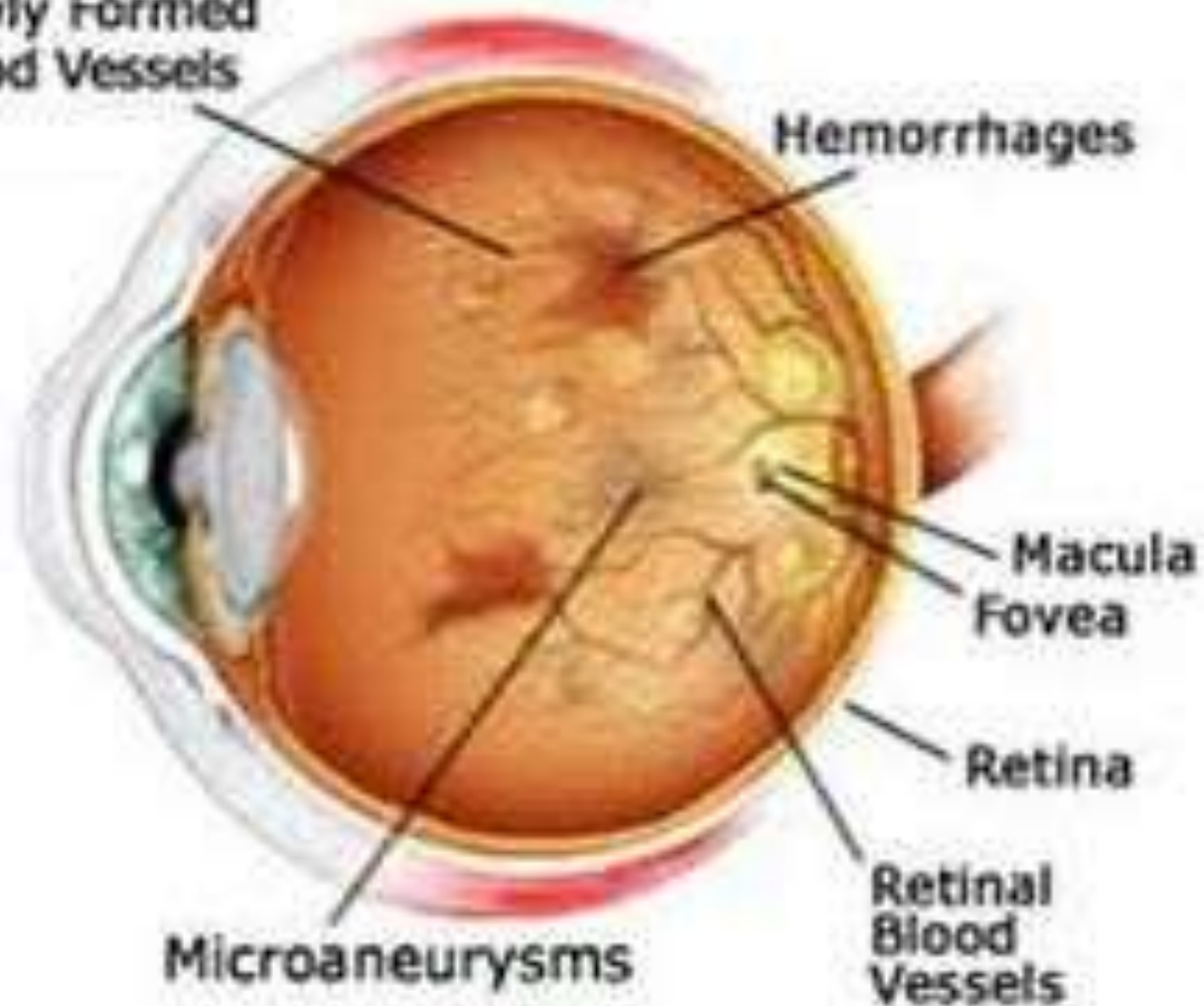
Hemorrhages

Macula
Fovea

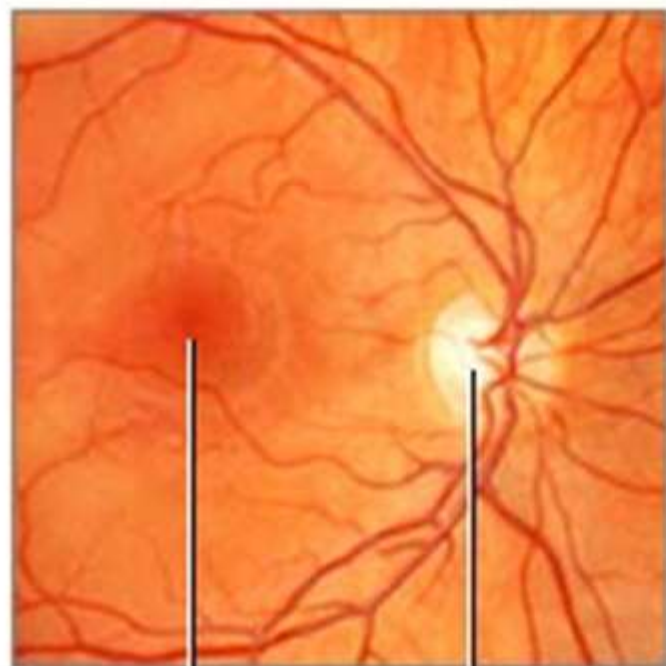
Retina

Microaneurysms

Retinal
Blood
Vessels



Normal retina



Macula

Optic disk

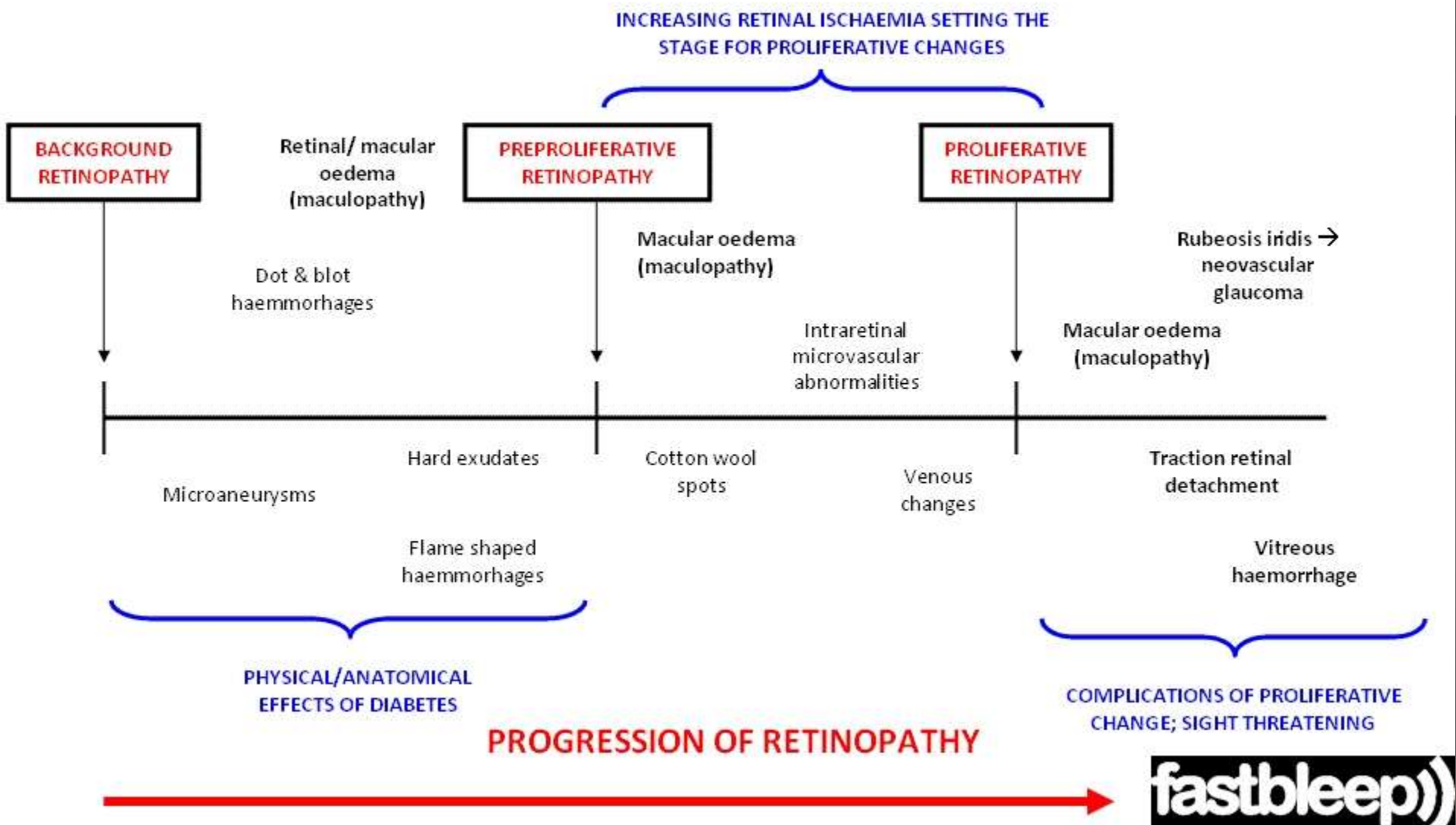
Retinopathy

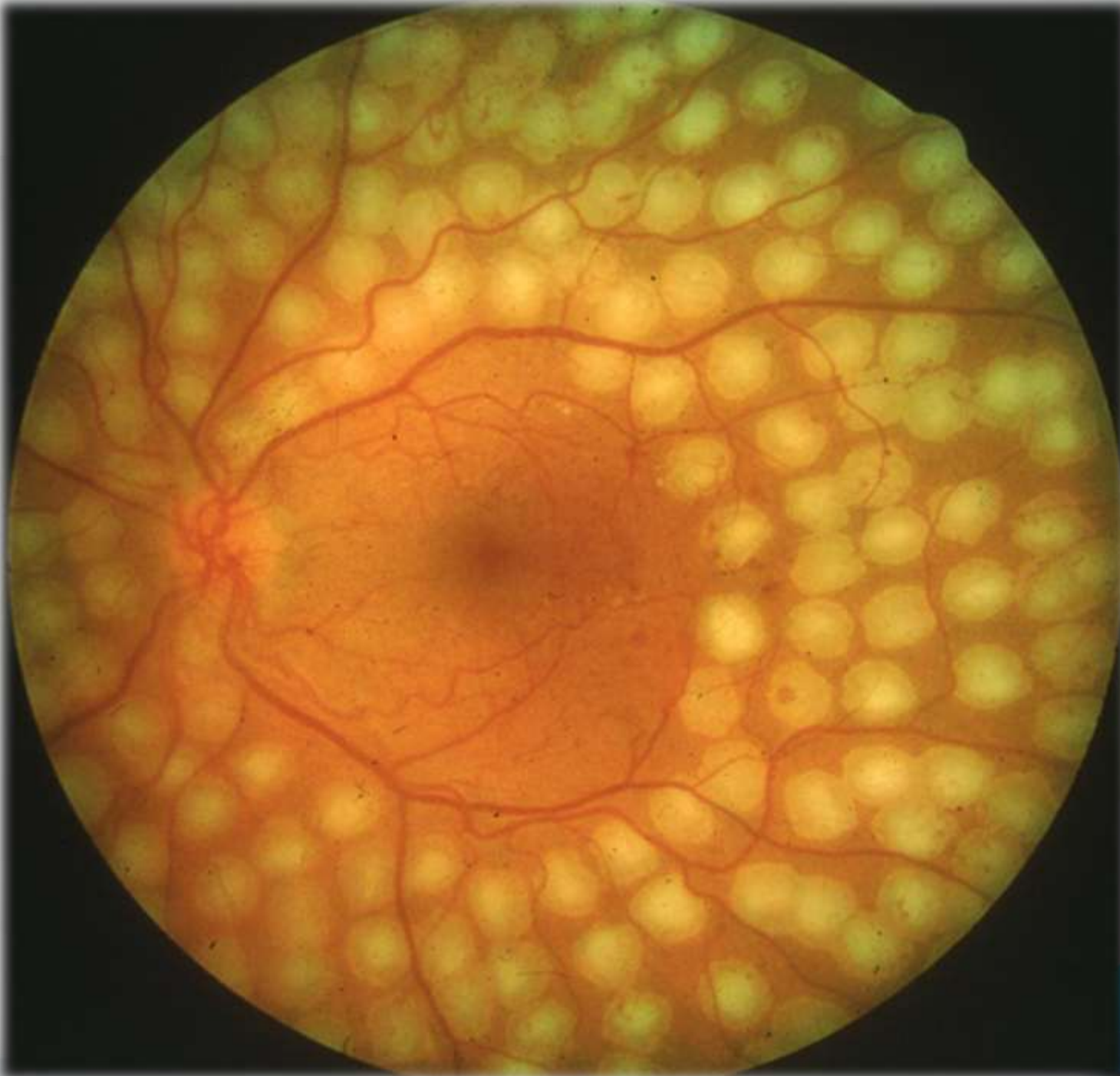


Hemorrhage

Aneurysms



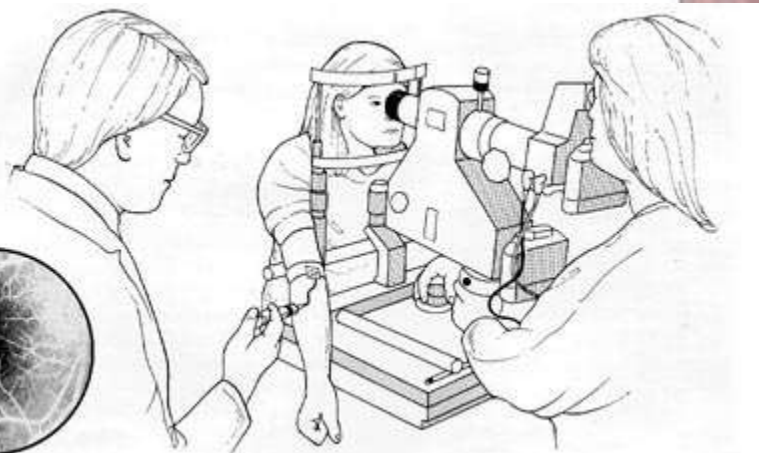
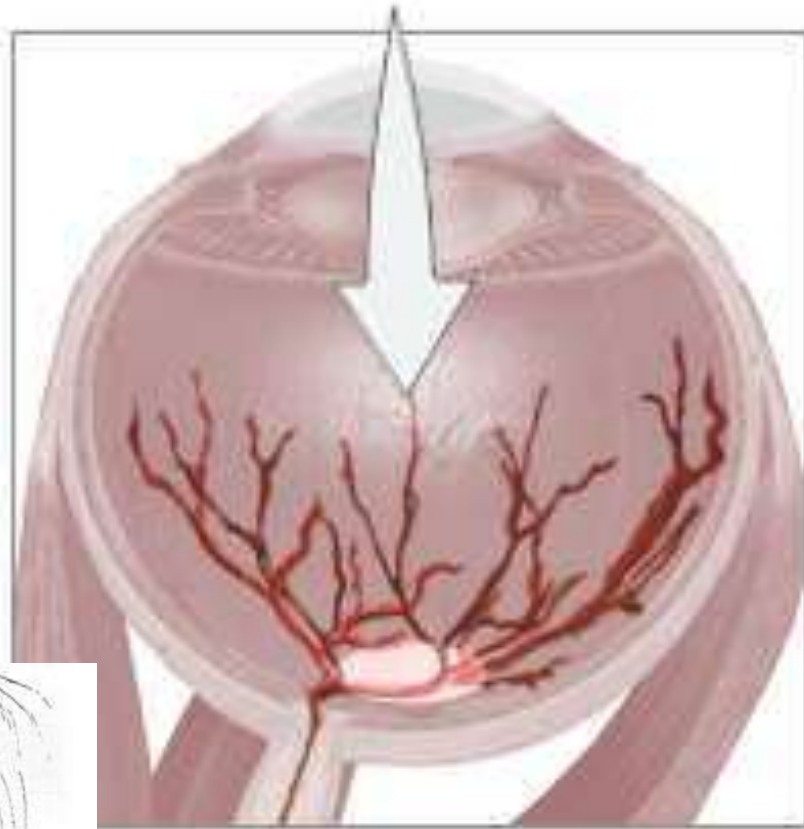


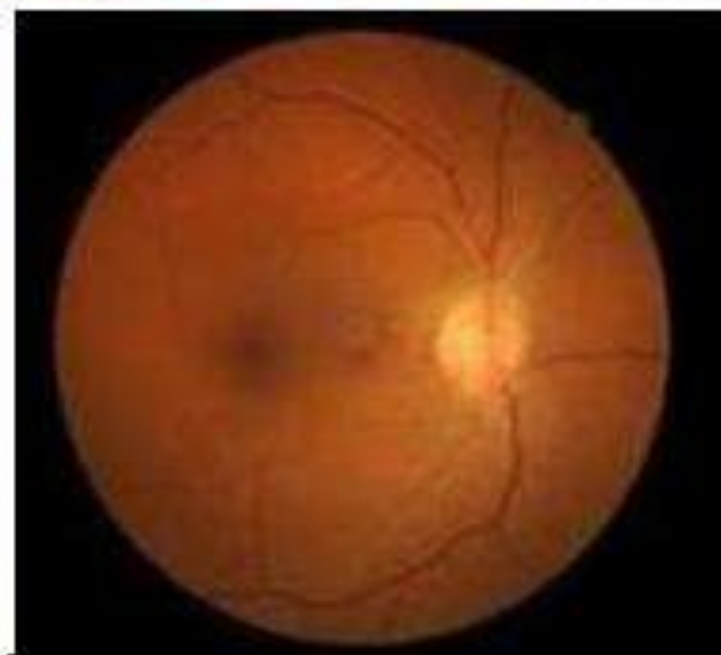


Vessels of the retina
are photographed before and
after dye is injected



Special dye is
injected





Risks & Side Effects

- temporary yellowing of skin, conjunctiva (6-12 hours)
- yellowish-orange urine (24-36 hours)
- transient nausea (3-5%)
- vomiting <3%
- dye extravasation--> severe pain



**Fluorescein colors
urine fluorescent green.
This is entirely normal
and may take two days
to wear off.**



- Diabetic retinopathy (DR) develops in nearly all persons with type 1 diabetes and in more than 77% of those with type 2 diabetes, who survive for over 20 years with the disease.
- Retinopathy often accompanies ESRD in diabetes.





Diabetes
and
Foot Care

**PUT FEET FIRST
PREVENT
AMPUTATIONS**

**Every 30
seconds a
lower limb is
lost
somewhere
in the world
as a
consequence
of diabetes**



NEUROPATHY

Nerve Damage

ISCHEMIA

Reduced Blood Supply

Pain

Callus

Numbness

Deformity

Ulcers

Gangrene

DIABETIC FOOT



Table 1. Risk Factors for Foot Ulcers

- Diabetes for ≥ 10 years
- Previous amputation
- Past foot ulcer history
- Peripheral neuropathy
- Peripheral vascular disease
- Poor glycemic control ($\text{HbA}_{1\text{C}} > 9\%$)
- Visual impairment
- Diabetic nephropathy
- Dialysis
- Foot deformity
- Nicotine use/cigarette smoking

Lavery LA, Armstrong DG, Vela SA, et al. Practical criteria for screening patients at high risk for diabetic foot ulceration. *Arch Intern Med.* 1998;158:157-162. -



DIABETIC NEUROPATHY

SENSORY

MOTOR

AUTONOMIC

DEMYELINIZATION

Impaired sensory perception of:

- Pain
- Temperature
- Vibration
- Touch

Small muscle atrophy

Imbalance in flexor & extensor muscles

Clawed toes

Prominent metatarsal heads

Altered gait

Callus

Decreased sweating

Dry scaly skin

Fissures

Infection

A-V shunt

↓ Cell nutrition

↓ Capillary pressure

Edema

Poor healing

Injury

- Mechanical
- Thermal
- Chemical

FOOT ULCER



DIABETES MELLITUS

NEUROPATHY

SOMATIC

Reduced pain and proprioception

Restricted joint mobility

INCREASED FOOT PRESSURES

Small muscle weakness

AUTONOMIC

Absence of pressures

Impaired blood flow regulation

Dry skin fissures

Dilated foot veins
Dry foot

CALLUS

PERIPHERAL VASCULAR DISEASE

MICRO-ANGIOPATHY

FOOT ISCHEMIA

FOOT ULCERATION

INFECTION

AMPUTATION

Diabetes Is the Strongest Risk Factor for Lower-Extremity Amputation in New Hemodialysis Patients

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ESRD patients can aid in the design of preventive efforts.

Patients with diabetes have a greatly elevated risk of developing ESRD (2), and the rate of LEA in U.S. ESRD patients with

CONCLUSIONS—diabetes is a potent risk factor for LEA in new hemodialysis patients. In ESRD patients with diabetes, a multipronged approach may reduce the rate of LEA. Potentially beneficial strategies include adherence to hemodialysis adequacy guidelines, aggressive treatment of cardiovascular comorbidities, and the utilization of LEA prevention strategies recommended for the general population of patients with diabetes.

Diabetes Care 27:2198–2203, 2004

The diabetic foot in end stage renal disease.

Papanas N¹, Liakopoulos V, Maltezos E, Stefanidis I.

⊕ Author information

Abstract

Diabetic foot lesions remain a major cause of morbidity in patients with renal failure, especially those on dialysis. Foot complications are encountered at a more than twofold frequency in diabetic patients with end-stage renal disease, and the rate of amputations is 6.5-10 times higher in comparison to the general diabetic population. The causal pathways of the diabetic foot in renal failure are multiple and inter-related. Three major pathologies—neuropathy, ischemia, and infection—are the main contributory factors. Increased awareness of this condition and careful clinical examination are indispensable to avoid serious complications. Appropriate management needs to address all contributory factors. Treatment options include revascularization, off-loading to relieve high-pressure areas, and aggressive control of infection. Equally important is the collaboration between health care providers in a multidisciplinary foot care setting. Moreover, patient education on the measures required to achieve both primary and secondary prevention is of great value. Certainly, technical innovations have made considerable progress possible, but there is a need for further improvement to reduce the number of amputations.

Foot complications are encountered at a more than twofold frequency in diabetic patients with end-stage renal disease, and the rate of amputations is 6.5-10 times higher in comparison to the general diabetic population.



Prevalence of risk factors for foot ulceration in patients with end-stage renal disease on haemodialysis.

Kaminski M¹, Frescos N, Tucker S.

⊕ Author information

Abstract

BACKGROUND: End-stage renal disease (ESRD) has been associated with foot ulceration and lower extremity amputation (LEA). However, the underlying risk factors for foot ulceration have received limited attention in this population.

AIM: The aim of this study was to investigate the prevalence and type of risk factors for foot ulceration present in patients with ESRD on haemodialysis without the coexistence of diabetes mellitus (DM).

METHODS: One hundred and ninety participants with ESRD and/or DM were recruited over a 6-week period. Participants were allocated into one of three groups: (i) ESRD without DM; (ii) DM without ESRD; and (iii) coexisting ESRD and DM. Participants were screened for the risk factors for foot ulceration. Statistical comparisons were made between the three groups for both the prevalence and type of risk factors using a Fisher's exact test.

RESULTS: Risk factors for foot ulceration were found to be highly prevalent in the ESRD population. Participants with both ESRD and DM exhibited statistically significant differences in risk factor presentation for peripheral neuropathy ($P=0.033$), vascular insufficiency ($P=0.001$) and footwear ($P=0.037$) in comparison with participants with DM alone.

CONCLUSION: There are high prevalence rates of risk factors for foot ulceration in the ESRD population on haemodialysis and are comparable with those with DM. Individuals with coexisting ESRD and DM have an even greater risk for foot ulceration and LEA. This highlights the importance that regular foot screening, preventative education and treatment are necessary for patients with ESRD potentially to reduce the risk of foot ulcerations and LEAs.

© 2011 The Authors. Internal Medicine Journal © 2011 Royal Australasian College of Physicians.



Kidney transplantation in type 2 diabetic patients: a comparison with matched non-diabetic subjects

Nephrol. Dial. Transplant. (2002)17 (9): 1678-1683.

Petr Boucek, Frantisek Saudek, Eva Pokorna, Stefan Vitko, Milos Adamec, Radomira Koznarova and Vera Lanska

Conclusions. Patient and graft survival after kidney transplantation was similar in type 2 diabetic and matched non-diabetic subjects, with more amputations occurring in the diabetic group(diabetic vs non-diabetic group: 8 vs 0, $P=0.01$)..



Foot ulcers are more likely to develop in patients with diabetic nephropathy, also they are less likely to heal than are those in diabetic patients with normal renal function.



Peripheral neuropathy is
present in
almost all patients with
advanced nephropathy.
Nearly all patients
with nephropathy have
grossly abnormal results on
autonomic function tests.

Astrup AS, Tarnow L, Rossing P, et al. Cardiac autonomic neuropathy predicts cardiovascular morbidity and mortality in type 1 diabetic patients with diabetic nephropathy. *Diabetes Care*. 2006;29(2):334-339



Foot ulcers
with sepsis leading to
amputation occur
frequently (>25%
of cases), **probably due**
to a combination of
neural and arterial
disease.



Amputation

At the start of hemodialysis 16% of diabetic patients have undergone amputation, most frequently above-the-ankle amputation.

Schomig M, Ritz E, Standl E, et al. The diabetic foot in the dialyzed patient. *J Am Soc Nephrol*. 2000;11(6):1153-1159.



Amputation

The presence of diabetic foot lesions is the most powerful predictor of survival in diabetic dialysis patients, possibly as a result of the associated microinflammatory state.





DIABETIC HEART DISEASE



CKD

CVD

Kidney Failure

Heart Failure

End-Stage

Decreased GFR

Progression

CVD Events

Albuminuria

Initiation

CAD, LVH

At Increased Risk

DIABETES

HTN, Age, Family History

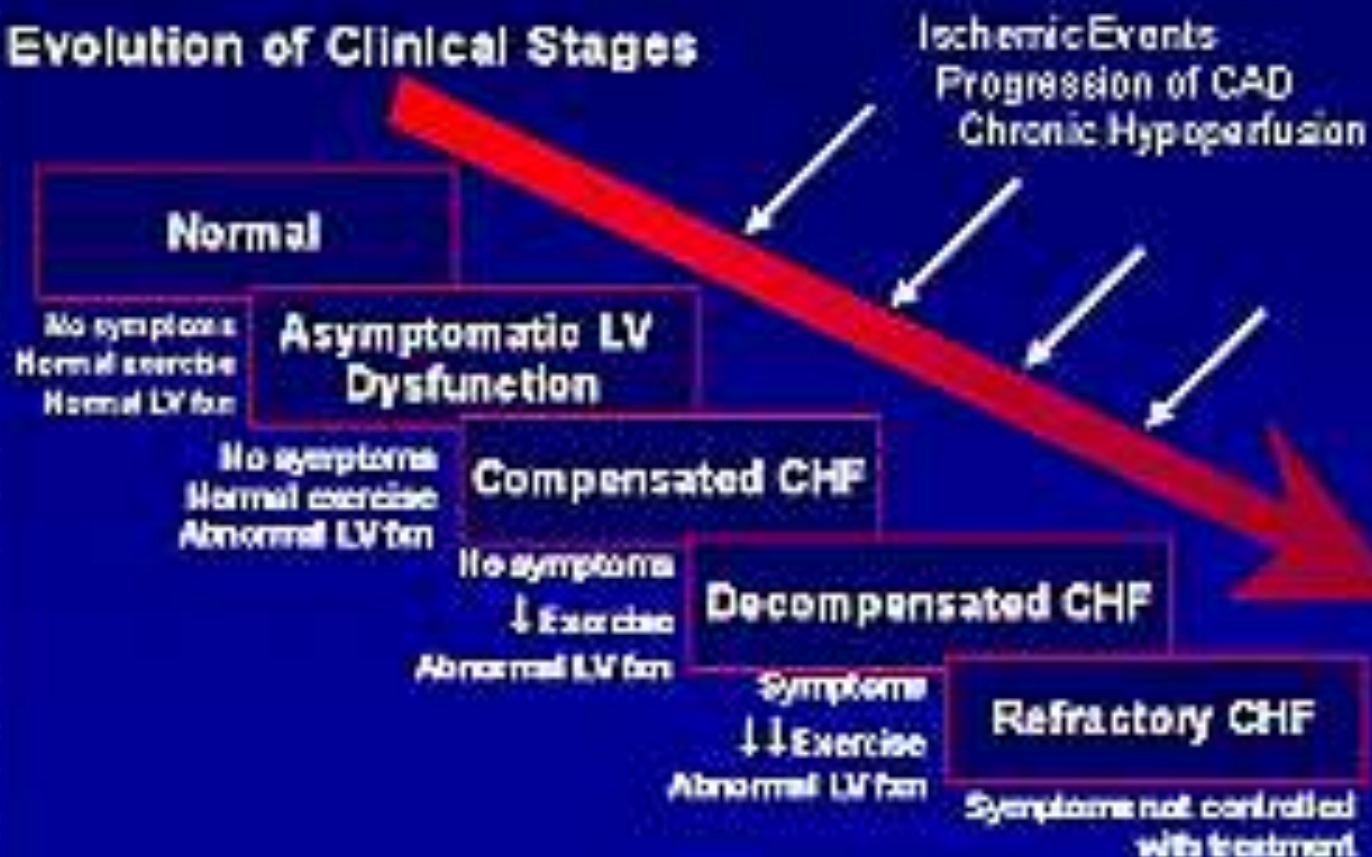


DIABETIC HEART DISEASE



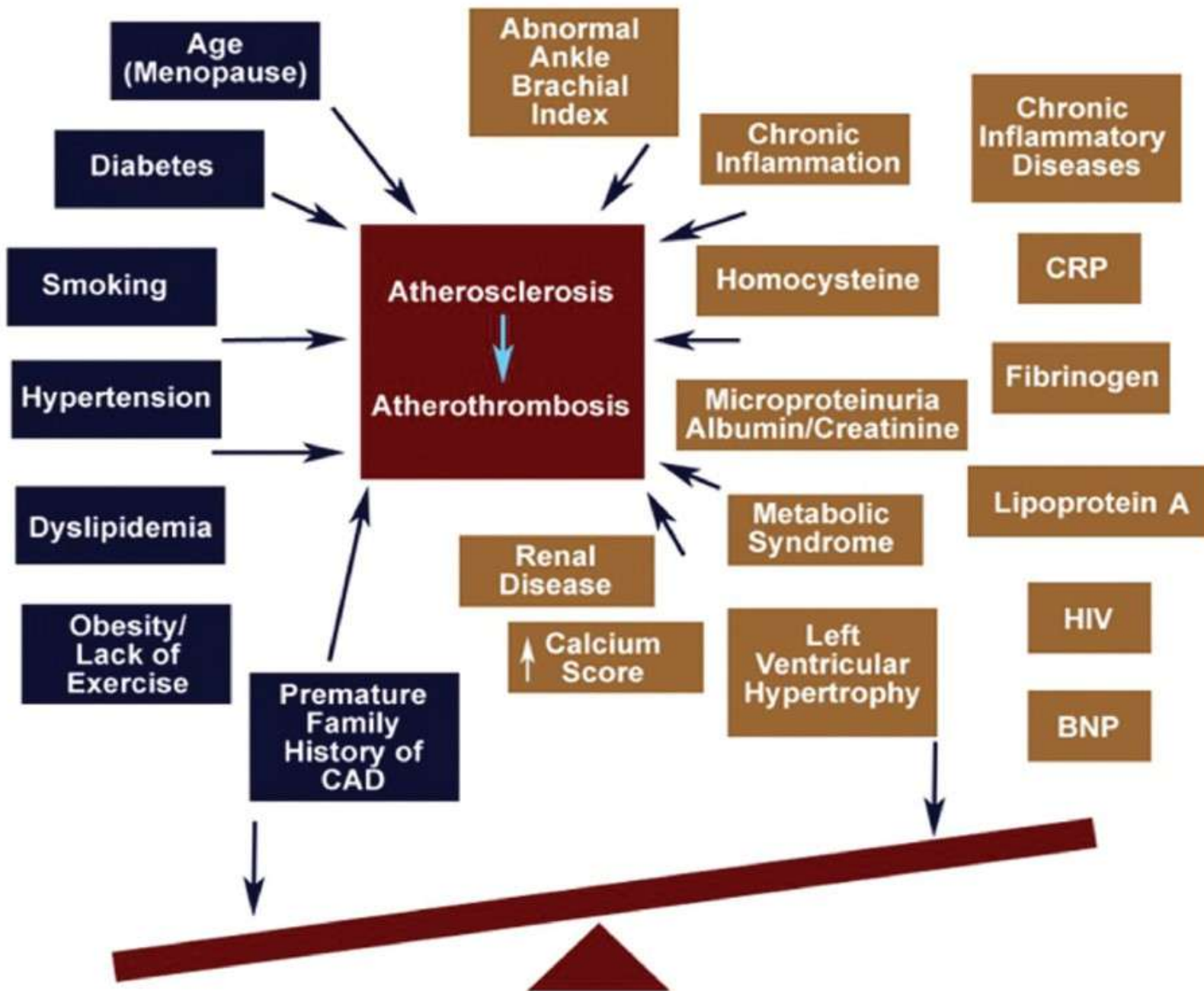
Ischemic Heart Failure

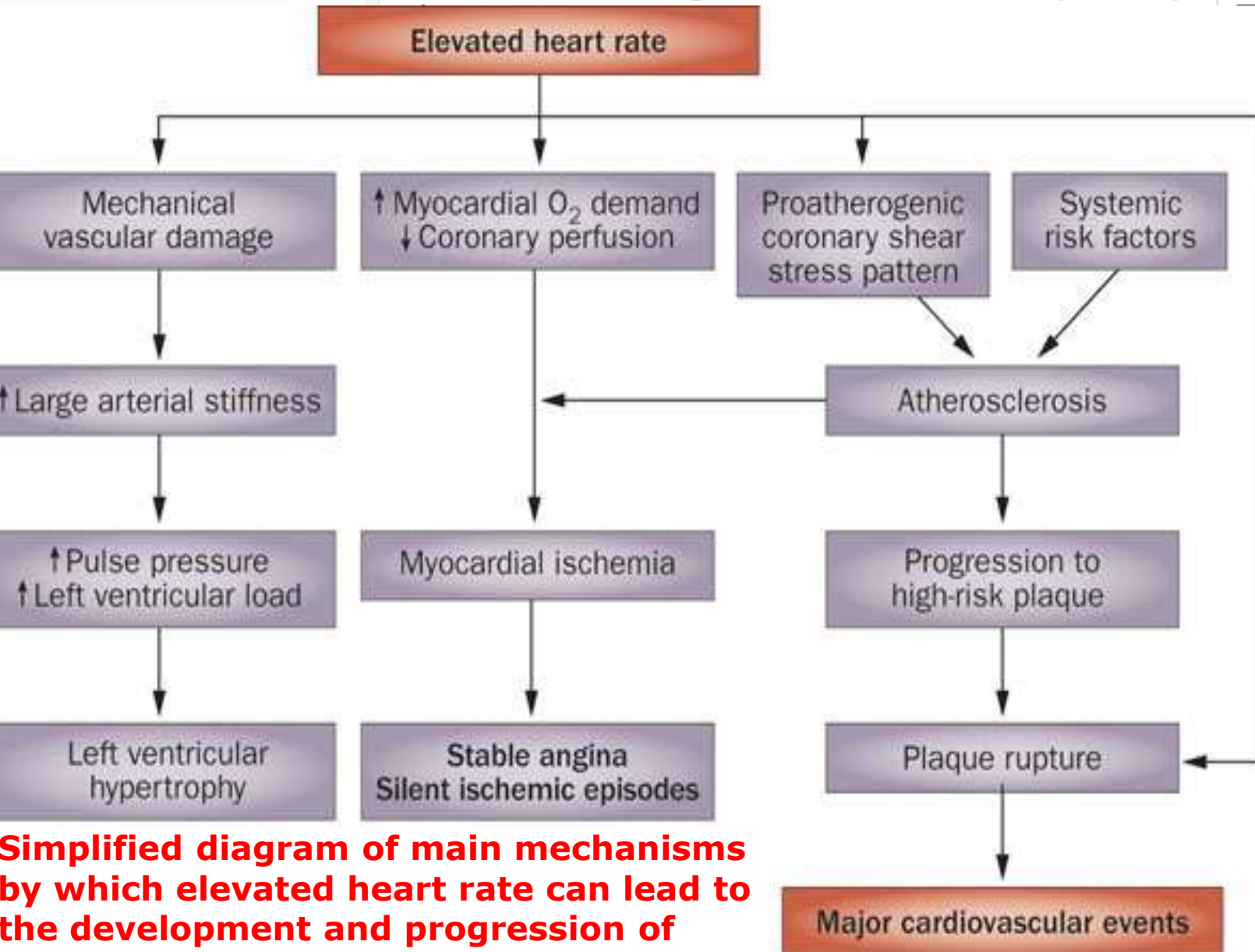
Evolution of Clinical Stages



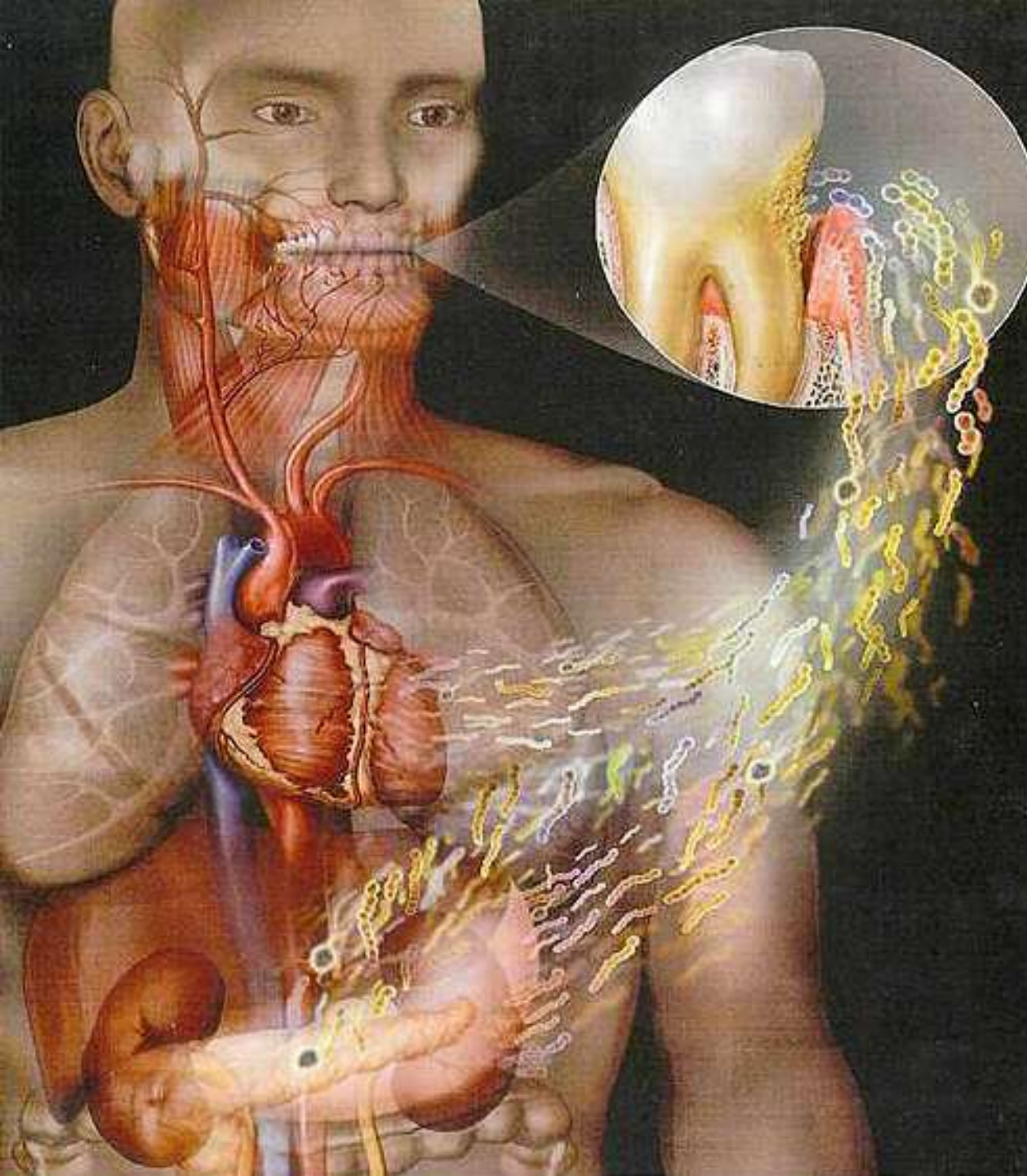
Traditional Risk Factors


Non-Traditional Risk Factors





Simplified diagram of main mechanisms by which elevated heart rate can lead to the development and progression of coronary artery disease.





Correlation
does not imply
causation.





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Commentary

Kidney International (2009) **75**, 672–674. doi:10.1038/ki.2009.15

Periodontal disease: a modifiable risk factor for cardiovascular disease in ESRD patients?

François Madore¹

¹Hôpital du Sacré-Coeur de Montréal, Montréal, Quebec, Canada



DIABETIC HEART DISEASE

Selected factors potentially affecting coronary artery disease (CAD) progression and/or outcomes following percutaneous coronary intervention (PCI) among diabetic patients.

Inflammation

hsCRP ↑, IL-6 ↑, VCAM-1 ↑, ICAM-1 ↑
P-selectin ↑, sCD40L ↑, TNF-α ↑, TSP-1 ↑

Prothrombotic State

GP IIb/IIIa receptors ↑
Platelet factor 4 ↑
Fibrinogen ↑, TF ↑, vWF ↑
PAI-1 ↑
Protein C ↓

CAD Progression and/or
Worse Outcomes post PCI

Endothelial Dysfunction

Hyperglycemia
Free fatty acid
Insulin resistance
RAGE/AGE ↑
Dyslipidemia

Restenosis

Hyperinsulinemia
RAGE/AGE ↑
PPAR-γ modulation
TSP-1 ↑

Associated Conditions



Renal dysfunction
LV dysfunction
Peripheral vascular disease

Atherosclerotic Burden

Diffuse disease
Multivessel disease
Negative remodeling



Clinical Outcomes of Patients With Diabetic Nephropathy Randomized to Clopidogrel Plus Aspirin Versus Aspirin Alone (A post hoc Analysis of the Clopidogrel for High Atherothrombotic Risk and Ischemic Stabilization, Management, and Avoidance [CHARISMA] Trial)

[Arijit Dasgupta, MD](#)  , [Steven R. Steinhubl, MD](#), [Deepak L. Bhatt, MD, MPH](#), [Peter B. Berger, MD](#), [Mingyuan Shao, MSc](#), [Koon-Hou Mak, MD](#), [Keith A.A. Fox, MB, ChB](#), [Gilles Montalescot, MD, PhD](#), [Michael A. Weber, MD](#), [Steven M. Haffner, MD](#), [Alexios P. Dimas, MD](#), [P. Gabriel Steg, MD](#), [Eric J. Topol, MD](#), [CHARISMA Investigators](#)

Received: October 24, 2008; Received in revised form: January 23, 2009; Accepted: January 23, 2009; Published Online: April 03, 2009

In conclusion, this post hoc analysis suggested that clopidogrel may be harmful in patients with diabetic nephropathy.



Total cardiovascular risk stratification

Other risk factors (RF), asymptomatic organ damage (OD) or disease	Blood Pressure (mmHg)			
	High normal SBP 130-139 or DBP 85-89	Grade 1 HT SBP 140-159 or DBP 90-99	Grade 2 HT SBP 160-179 or DBP 100-109	Grade 3 HT SBP ≥ 180 or DBP ≥ 110
No other RF		Low risk	Moderate risk	High risk
1-2 RF	Low risk	Moderate risk	Moderate to High risk	High risk
≥ 3 RF	Low to moderate risk	Moderate to high risk	High risk	High risk
OD, CKD stage 3 or diabetes	Moderate to high risk	High risk	High risk	High to very high risk
Symptomatic CVD, CKD stage ≥ 4 or diabetes with OD/RFs	Very high risk	Very high risk	Very high risk	Very high risk

The ABCs of Avoiding Complications

Advice

Blood Pressure control

Cholesterol control

Dental Check

Eye Screening

Foot Screening

Glycemic Control



What should I do each day to stay healthy with diabetes?



Follow the healthy eating plan that you and your doctor or dietitian have worked out.



Be active a total of 30 minutes most days. Ask your doctor what activities are best for you.



Take your medicines as directed.



Check your blood glucose every day. Each time you check your blood glucose, write the number in your record book.



Check your feet every day for cuts, blisters, sores, swelling, redness, or sore toenails.



Brush and floss your teeth every day.



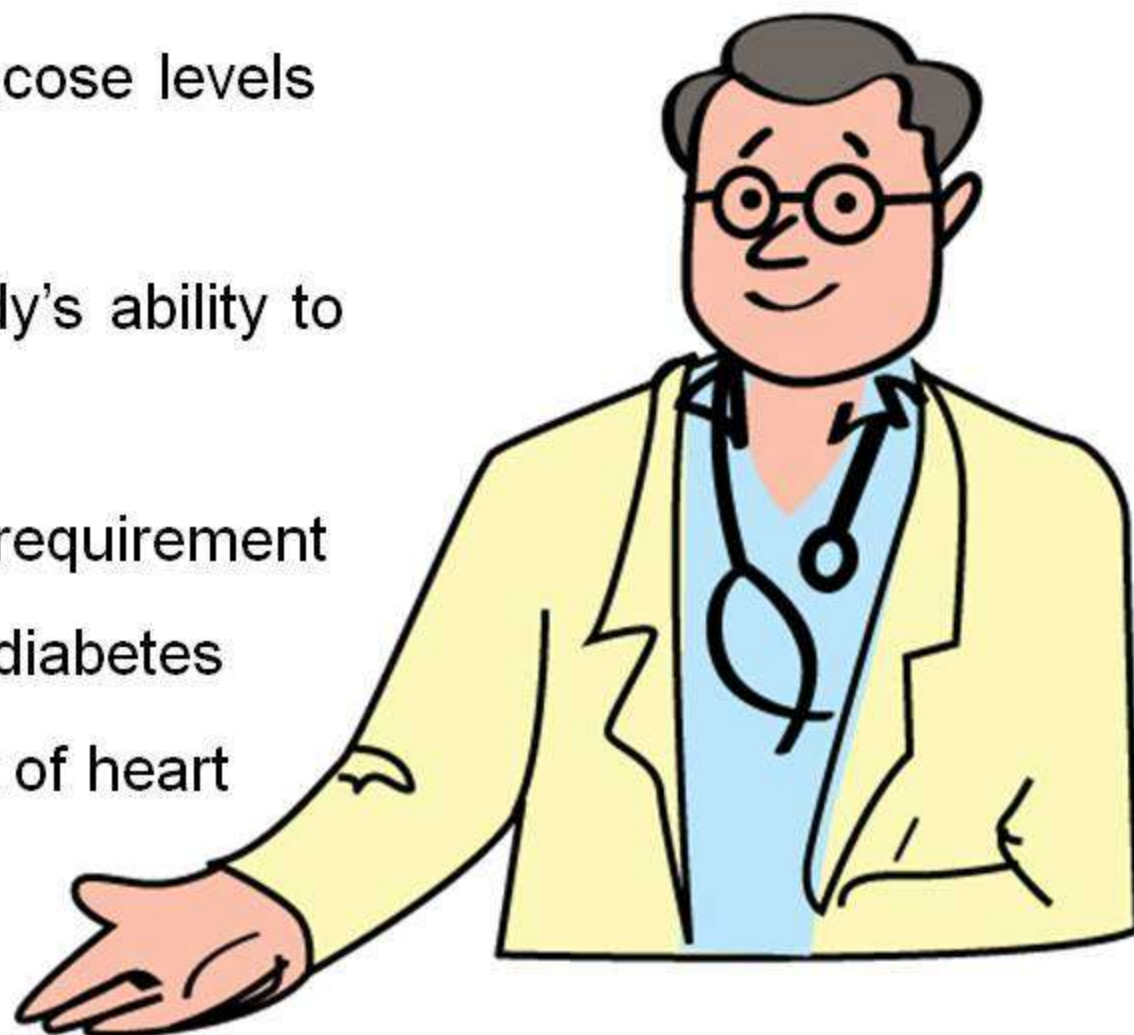
Control your blood pressure and cholesterol.



Don't smoke.

How does Exercise help?

- ✓Lowers blood glucose levels quickly
- ✓Improves the body's ability to use insulin
- ✓Reduces insulin requirement
- ✓Better control of diabetes
- ✓Reduces the risk of heart disease







Foot Care for People with Diabetes

CHANGINGlife
WITH DIABETES

People with diabetes have to take special care of their feet. You should have a comprehensive foot exam every year. This page shows some more things you can do to keep your feet healthy.



Wash your feet in warm water every day.



Ask your diabetes care team how you should care for your toenails.



Wear clean, soft socks that fit you.



Dry your feet well, especially between the toes.



Keep your feet warm and dry. Always wear shoes that fit well.



Keep the skin soft with a moisturizing lotion, but do not apply it between the toes.



Never walk barefoot indoors or outdoors.



Inspect your feet every day for cuts, bruises, blisters, or swelling. Tell your doctor right away if you find something wrong.



Examine your shoes every day for cracks, pebbles, nails, or anything that could hurt your feet.

Take good care of your feet – and use them. A brisk walk every day is good for you.



DO'S

- Be aware of foot conditions
- Alert care providers immediately if a problem is noted
- Inspect feet after removing shoes
- Wear white socks if at risk for wounds
- Daily foot hygiene & lubrication
- Regular toenail care
- Be fitted with proper footwear
- Regularly check shoes/orthotics for wear
- Select appropriate activities
- Optimize body weight/body mass index



DON'TS

- Walk barefoot
- Use dry heat on the feet
- Soak feet in hot water
- Use chemicals or sharp objects to remove calluses
- Trim ingrown, embedded toenail edges
- Use nail polish
- Wear new shoes without frequent checks
- Wear socks with constricting bands
- Wear inappropriate shoes
- Smoke tobacco



Figure 1. Do's and don'ts to prevent foot wounds in patients with diabetes. Advice to prevent diabetic foot wounds is largely common sense. Almost all advice is related directly or indirectly to sensation in the foot.

Adapted with permission from Best Publishing Co.^{35,36}

Shoes should fit comfortably



Avoid poor-fitting shoes

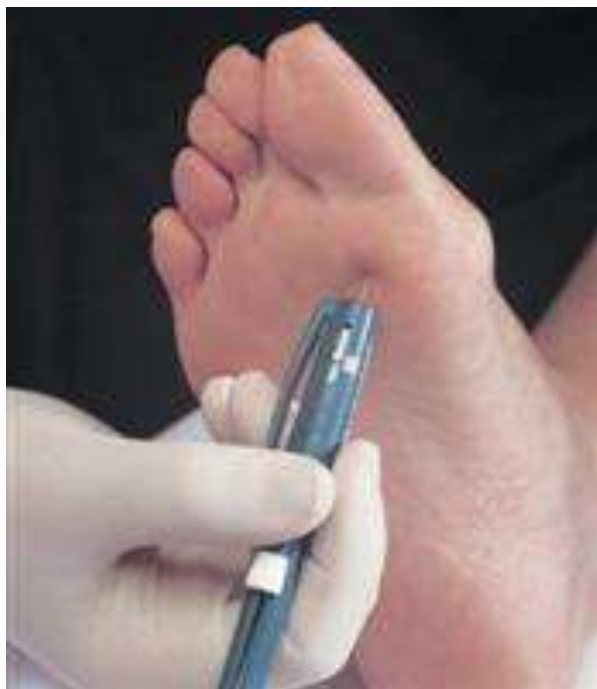


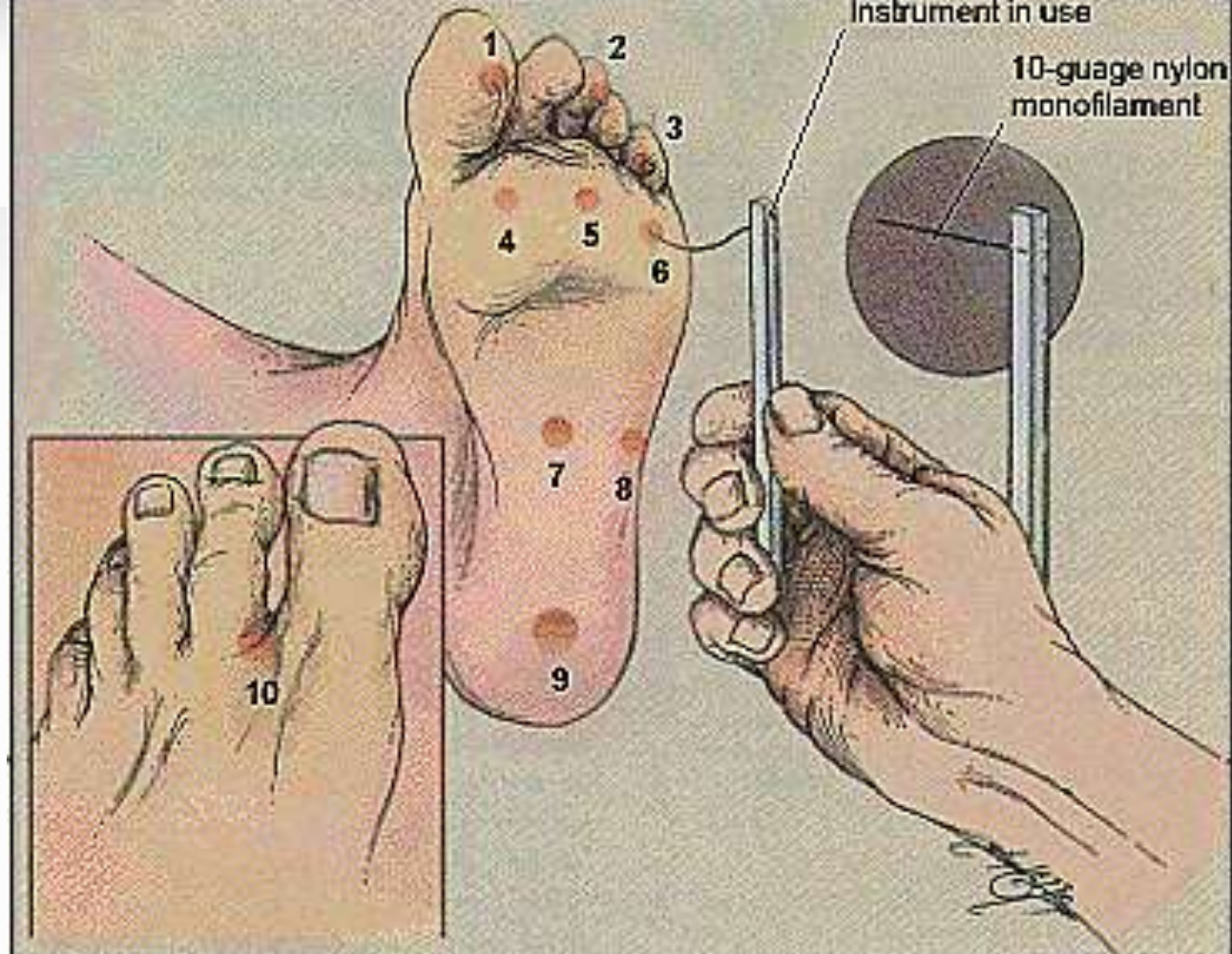
Thoroughly inspect
your feet daily, and
keep them clean
and dry



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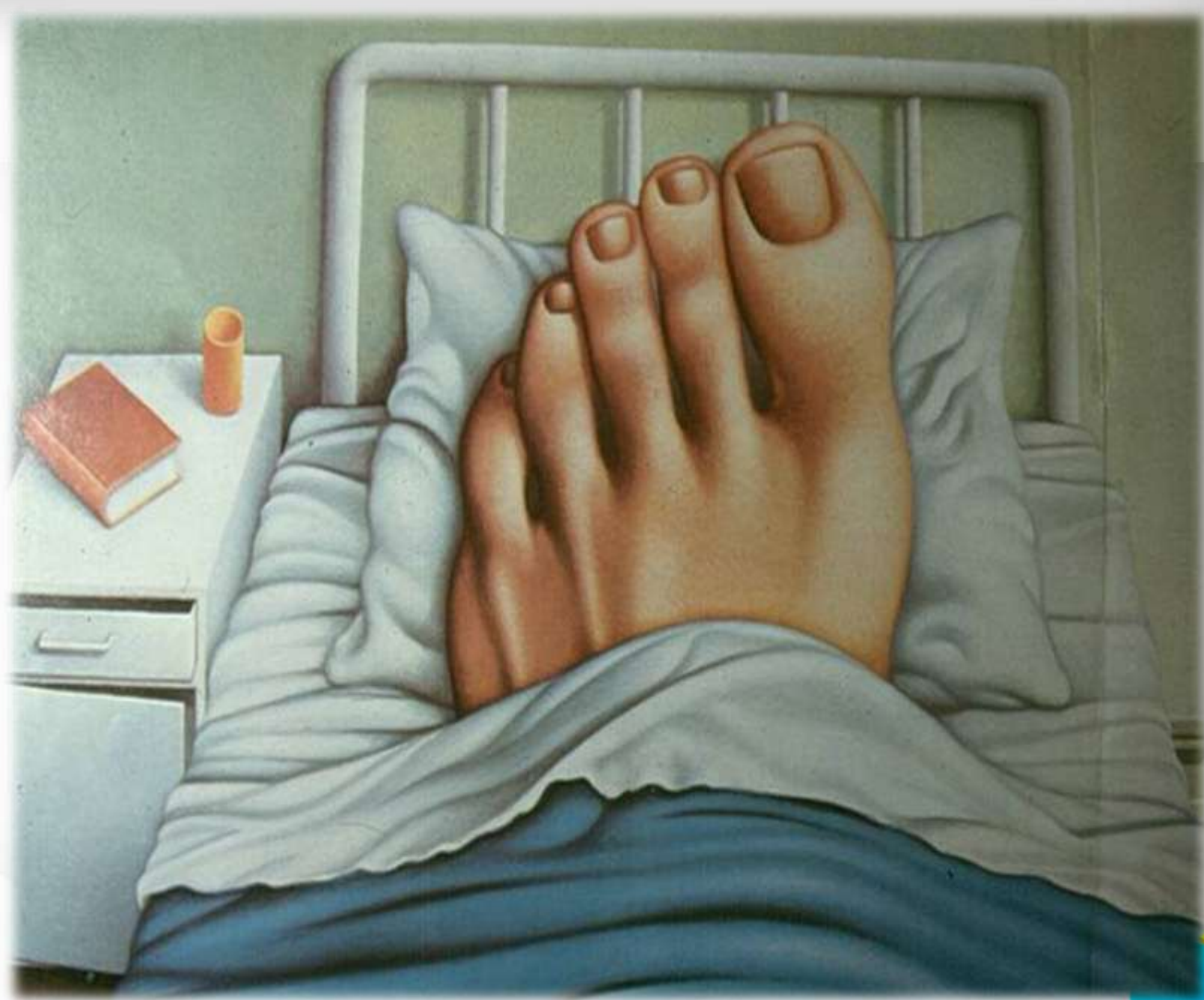


Nylon monofilament test. There is a risk of ulcer formation if the patient is unable to feel the monofilament when it is pressed against the foot with just enough pressure to bend the filament. The patient is asked to say "yes" each time he or she feels the filament. Failure to feel the filament at four of 10 sites is 97 percent sensitive and 83 percent specific for identifying loss of protective sensation.

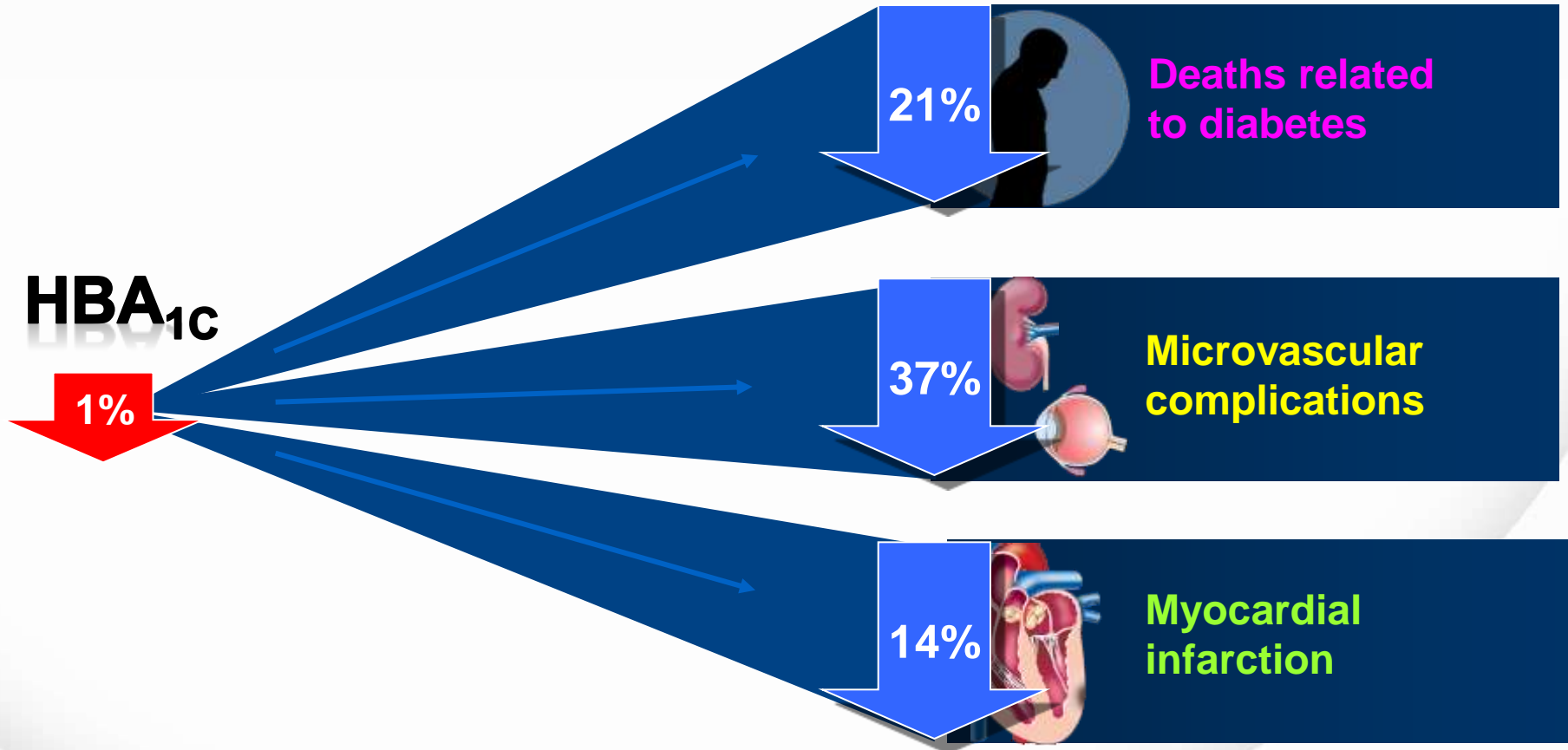




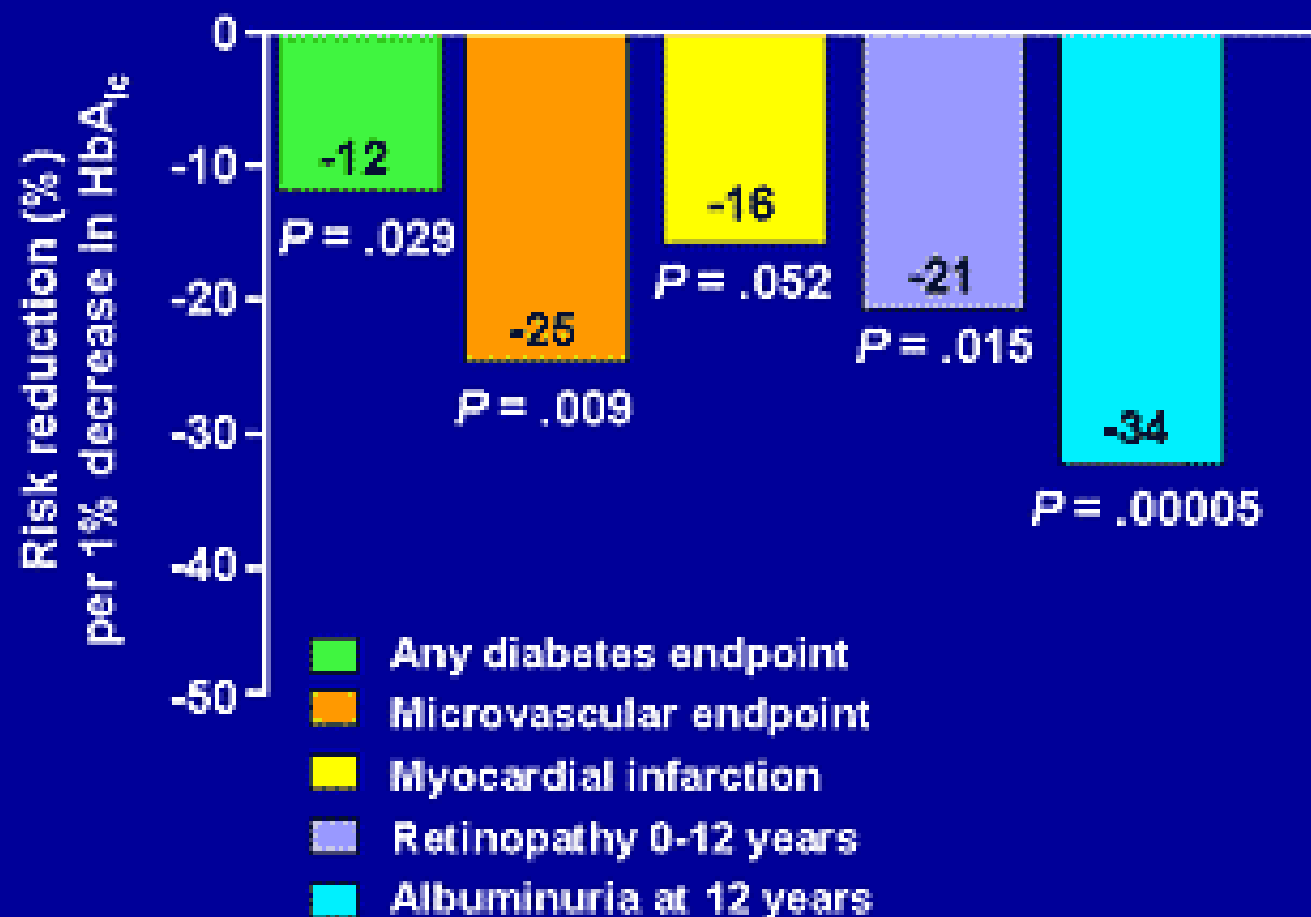




Lowering HbA_{1c} reduces the risk of complications



Lowering HbA_{1c} Reduces Risk of Diabetic Complications: UKPDS



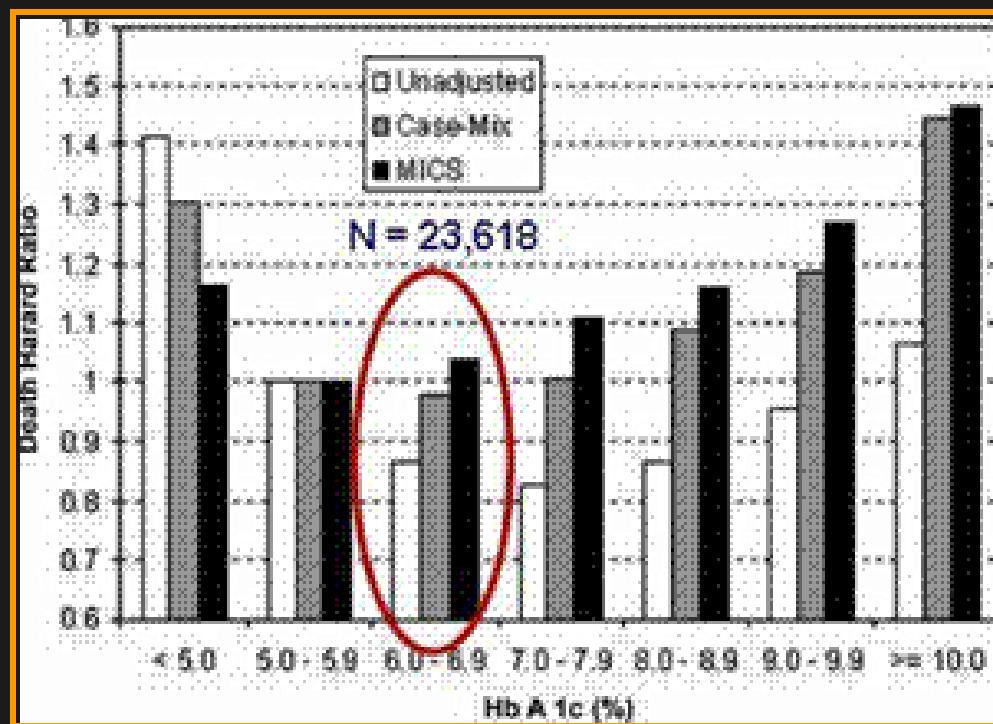
UK Prospective Diabetes Study Group. *Lancet*. 1998;352:837-853.

Benefits of optimum glycemic control in diabetic patients with chronic kidney disease.

- Lowers infection rate
- Shortens hospital stay
- Retards progression of associated micro- and macrovascular complications
- Delays progression of nephropathy in proteinuria stage
- Lowers incidence of cardiovascular events
- Improves electrolyte control
- Decreases gastropathy and neuropathy
- Reduces thirst and fluid overload
- Improves overall wellbeing

Reduces overall morbidity and mortality.

Glycohemoglobin and Mortality in Patients on Maintenance Hemodialysis



Kalantar-Zadeh, et al. Diabetes Care 30: 1049 (2007)

WCN 2009: Sudden Cardiac Death in Dialysis Patients Related to Poor Glycemic Control.

In Diabetic patients on hemodialysis, elevated glycated hemoglobin A1c (Hb_{A1c}) appears to be a strong risk factor for sudden cardiac death, according to an analysis from the German Diabetes and Dialysis (4D) Study, presented here at the World Congress of Nephrology, a Joint Meeting of the European Renal Association–European Dialysis and Transplant Association and the International Society of Nephrology.

Avoiding Hypoglycemia in HD diabetic patients

- Predialysis snacks
- Reduce morning insulin dose by 50% on dialysis day
- Addition of glucose to dialysate solution



PROFILES OF ANTIDIABETIC MEDICATIONS

	MET	DPP-4i	GLP-1 RA	TZD	AGI	COLSVL	BCR-QR	SU GLN	INSULIN	SGLT-2	PRAML
HYPO	Neutral	Neutral	Neutral	Neutral	Neutral	Neutral	Neutral	Moderate/ Severe Mild	Moderate to Severe	Neutral	Neutral
WEIGHT	Slight Loss	Neutral	Loss	Gain	Neutral	Neutral	Neutral	Gain	Gain	Loss	Loss
RENAL/ GU	Contra- indicated Stage 3B,4,5	Dose Adjustment May be Necessary (Except Linagliptin)	Exenatide Contra- indicated CrCl < 30	May Worsen Fluid Retention	Neutral	Neutral	Neutral	More Hypo Risk	More Hypo Risk & Fluid Retention	Infections	Neutral
GI Sx	Moderate	Neutral	Moderate	Neutral	Moderate	Mild	Moderate	Neutral	Neutral	Neutral	Moderate
CHF	Neutral	Neutral	Neutral	Moderate	Neutral	Neutral	Neutral	Neutral	Neutral	Neutral	Neutral
CVD	Benefit			Neutral			Safe	?			
BONE	Neutral	Neutral	Neutral	Moderate Bone Loss	Neutral	Neutral	Neutral	Neutral	Neutral	? Bone Loss	Neutral



Few adverse events or possible benefits



Use with caution



Likelihood of adverse effects

Should Everyone Take Metformin?

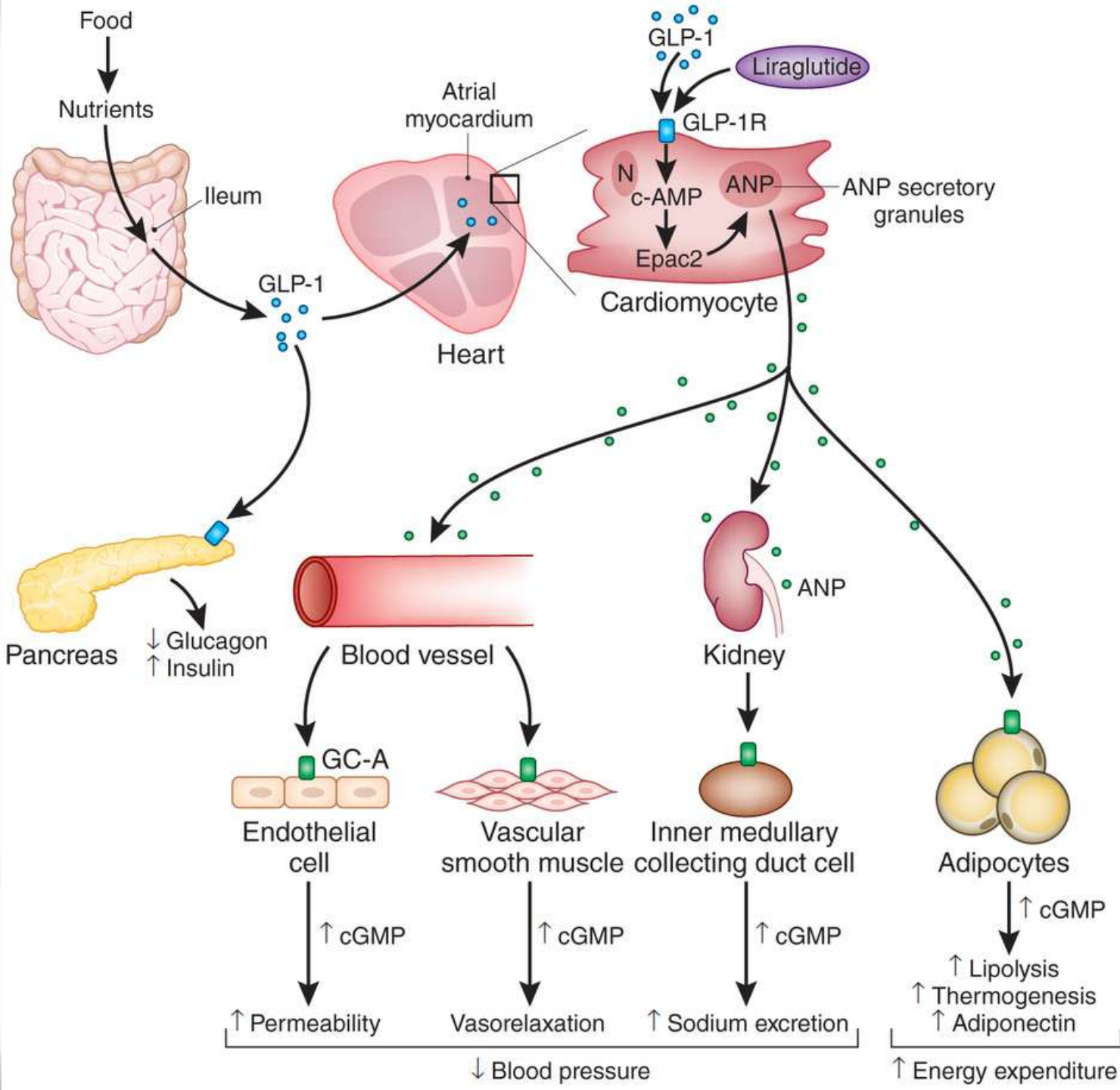
Gregory A. Nichols, PhD | December 04, 2014

Initial Choice of Oral Glucose-Lowering Medication for Diabetes Mellitus: A Patient-Centered Comparative Effectiveness Study

Berkowitz SA, Krumme AA, Avorn J, et al

JAMA Intern Med. 2014 Oct 27. [Epub ahead of print]





CONCLUSION



Table 3. Schedule of Follow-up for Patients With Diabetes[42]

Adults with diabetes should receive medical care from a physician-coordinated team of healthcare professionals. Referrals to these team members should be made as appropriate.

At each regular diabetes visit

- Measure weight and blood pressure
- Inspect feet if 1 or more high-risk foot condition is present
- Review self-monitoring glucose record
- Review/adjust medications to control glucose, lipids, and blood pressure. Include regular use of low-dose aspirin for CVD prevention as appropriate
- Review self-management skills, dietary needs, and physical activity
- Assess for depression or other mood disorders
- Counsel on smoking cessation and alcohol use

Quarterly

- Obtain A1C in patients whose therapy has changed or who are not meeting glycemic goals (twice a year if at goal with stable glycemia)

Annually

- Calculate body mass index
- Obtain fasting lipid profile (every 2 years if patient has low-risk lipid values)
- Obtain serum creatinine level to estimate glomerular filtration rate and stage the level of chronic kidney disease
- Perform urine test for albumin-to-creatinine ratio in patients with type 1 diabetes for more than 5 years and in all patients with type 2 diabetes
- Refer for dilated eye examination (if normal, an eye care specialist may advise an examination every 2-3 years)
- Perform comprehensive foot examination
- Refer for dental/oral examination at least once a year
- Administer influenza vaccination
- Review need for other preventive care or treatment

Lifetime

- Administer pneumococcal vaccination (repeat if older than 64 or immunocompromised and last vaccination was more than 5 years ago)

National Diabetes Education Program (NDEP). Diabetes numbers at-a-glance 2009.



ABCD OF DKD MANAGEMENT

A

B

C

D

ASA

B.P. CONTROL.

BLOCKERS OF RAS

CESSATION OF
SMOKING.

CHOLEST.
LOWERING DRUGS.

CARE OF:

- EYE.
- CVS.
- FEET.

DIET.

DM CONTROL.

DIALYSIS.

DOUBLE/SINGLE
ORGAN Tx.

**NEPHRO
LOGIST**

**CARDIO
LOGIST**

**DKD
CLINIC**

**OPHTHALMO
LOGIST**

PODIATRIST

**VASCULAR
SURGEON**



